

Food

& Beverages Processing

Ingredients Processing · Packaging · Technology

Anuga Foodtec Special

**Revolutionizing
Food Processing and
Packaging**

*The Role of Robotics and
Artificial Intelligence*

**From Formulations
to Smart Lines**

*Bridging Ingredient
Functionality and
Automation in Sweets,
Snacks, and Dairy*

**Natural
Preservatives
in Food**

*Emerging Alternatives
for Clean-Label Food
Products*



VF / W SERIES
WORM GEARMOTORS

What's Inside Makes **All the Difference.**

When you take a closer look inside a Bonfiglioli Worm Gearbox, you'll discover engineering details that cheaper alternatives simply don't offer.



Precision-Machined Gears

Optimized tooth geometry for quiet, efficient, and reliable torque transmission.



Single-Setup Machined Aluminium Housing

Built from premium raw material for maximum reliability and alignment accuracy.



Synthetic Oil (Polyglycol - PAG) Filled

Premium synthetic lubricant for lower maintenance and longer service intervals.



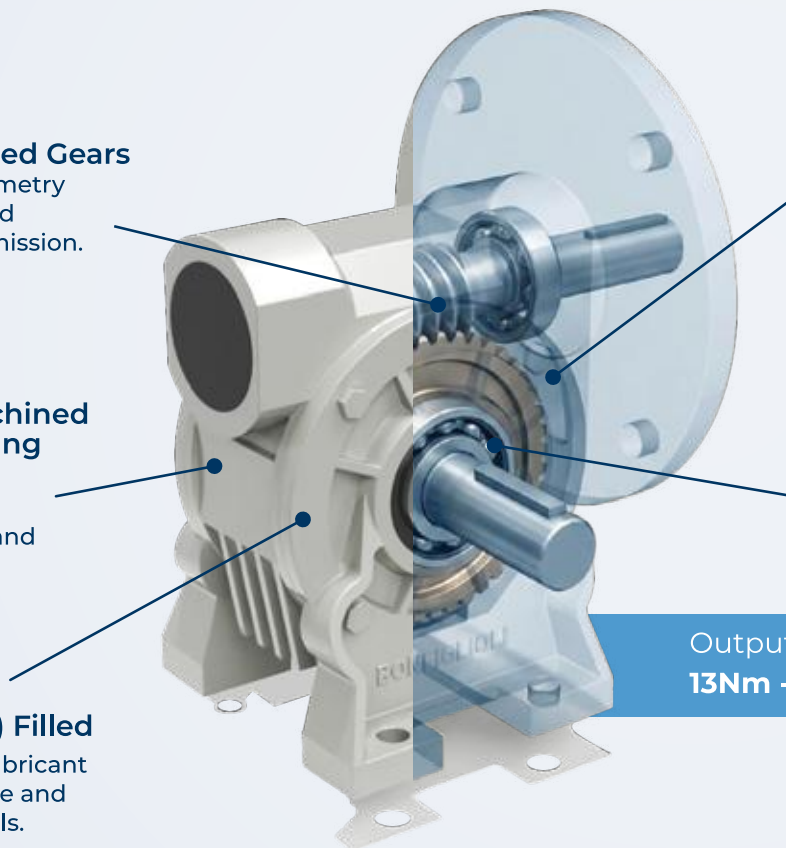
Phosphor Bronze Worm Wheel

Enhanced thermal efficiency with smoother and wear-resistant power transmission.



High-Quality Bearings & Seals

Designed for extended, trouble-free operating life.



Output Torque
13Nm - 7,100Nm

PREFERRED ACROSS SECTORS



**Food &
Beverage**



**Chemical
& Pharma**



**Indoor
Automation**



**Inclined
Conveyors**



Gates



Warehouses



**Packaging
& Labelling**

*When you choose a Bonfiglioli gearbox,
you're choosing peace of mind.*

www.bonfiglioli.in

For more details, call **+91 844 844 8649**

Ensure safe sealing in food processing



Advanced sealing technology for food processing and packaging equipment

Trusted by leading food processing and packaging original equipment manufacturers (OEMs) worldwide, Trelleborg Sealing Solutions triple-compliant FoodPro® materials meet some of the most stringent food contact regulations across the globe. Designed for compatibility with fats, oils, acidic ingredients and a wide range of food & dairy products, FoodPro® sealing solutions withstand demanding CIP and SIP cycles while delivering reliable, long-lasting performance. Backed by GMP-compliant manufacturing our FoodPro® range simplifies material selection, maximizes uptime and helps you safeguard food safety with confidence.



Scan to learn more

Trelleborg Sealing Solutions
#22/9, Beratena Agrahara, Hosur Main Road,
Bangalore, Karnataka, India, tss.salesindia@trelleborg.com





29 | **30** | **01**
SEPT | SEPT | OCT
BOMBAY EXHIBITION
CENTRE, MUMBAI **2026**

**ONE EVENT,
ENDLESS
OPPORTUNITIES**

**REGISTER
TODAY!**



What To Expect In 2026 Edition?



25,000+
Trade Visitors



65+
Country
Representations



450+
Leading
Exhibitors



13,500+ sqm
of Exhibition
Space

Global Country Pavilions



Brazil



China



EU



Georgia



Germany



Indonesia



Italy



Philippines



Saudi Arabia



South Korea



Spain



Thailand



Turkey

And
may more...

Contact Details

Akshata Ayare

a.ayare@koelnmesse-india.com +91 80971 26313

**VISITOR
REGISTRATION
IS NOW LIVE!**



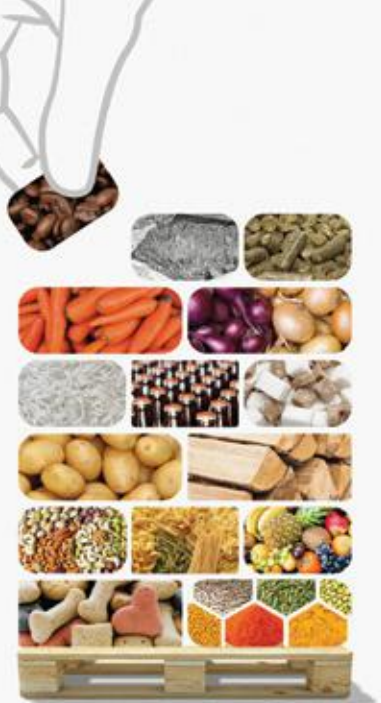
Palletizing machines for bags & boxes.

Automated. Reliable. Future-ready.



VPM-BL

- Limited footprint for space efficiency
- Low and high level infeed for easy loading and smooth integration



Effortless stacking, No matter the product.



VPM-8

- Fully automatic for minimal labor
- High stacking quality for stable loads
- High level infeed for smooth flow
- Automatic pallet transport system for seamless logistics



50% MORE STORAGE SPACE

99% LESS STICKING LABOUR



From boxes to bags,
from light to heavy.
Always perfectly stacked



V-STACK® 315

- High-speed stacking for increased efficiency
- Low energy consumption for cost savings





Editorial Note

Publisher
Harish Chaudhary

Editorial Board
Ms. Kanika Banga
Ritesh Verma
Amarpreet Singh
Prof. Dr. Mahendra Pal

Sub-Editor
Mrs. Preeti Kohli

Layout & Design
Suresh Singh Negi

Director - Marketing & Events
Dharmendra Tripathy
dharmendra@dvrpublication.com
+91-9555837779

Director - Finance
Ram Chaudhary
ram@dvrpublication.com
+91-9555837771

Marketing Manager
Shyam Choudhary
shyam@dvrpublication.com
+91-9999383836

Marketing Executive
Ms. Anjali

Web Designer
Subhash Pandey

Printer
Dominant Sales Corp.
11/104, Geeta Colony, Delhi- 110031

Company Information

DVR Publication Pvt. Ltd.
D-101, Gazipur Near Lavin International
School, Delhi – 110096
www.dvrpublication.com
www.foodnbeveragesprocessing.com
info@dvrpublication.com

Editor- Articles & information published herein have been collected from various sources, which are considered to be reliable. Individual and companies are however requested to verify the facts before making business decisions using the same. No part of this publication may be reproduced and transmitted by any means without the written permission of the publisher. Please send your valuable suggestions to info@dvrpublication.com



Dear Readers,

We're excited to bring you the Sept - 2026 edition of our magazine.

The September 2026 edition of Food & Beverage Processing Magazine is dedicated to one of the most anticipated platforms for the food and beverage processing industry, Anuga FoodTec India 2026, being held in Mumbai from 29 September to 1 October 2026. As a leading exhibition showcasing the latest technologies, equipment, solutions, and innovations across the food and beverage value chain, the event brings together industry leaders, technology providers, manufacturers, and professionals under one roof. We invite food and beverage industry professionals to visit this mega event, explore the latest innovations, connect with technology experts, and witness the technologies shaping the future of food processing and packaging.

In our Food Processing Technology segment, we look at how technology is transforming the way food products are developed and manufactured. Changing consumer preferences are encouraging manufacturers to focus on healthier products while maintaining taste, quality, scalability, and cost efficiency. This edition explores the role of smarter processing technologies in developing healthier snacks, while also examining how ingredient functionality can be integrated with automated production lines across the sweets, snacks, and dairy sectors. We further explore the growing influence of robotics and artificial intelligence, which are increasingly becoming important tools for improving productivity, precision, quality control, and operational efficiency in food processing and packaging.

The Packaging Technology section focuses on the industry's shift towards more sustainable and efficient packaging solutions. We examine how changing environmental priorities are influencing material and format selection, while technological advancements are enabling packaging manufacturers to achieve

better product protection, sustainability, and operational efficiency.

In the Ingredients & Additives segment, we look at the growing demand for natural and clean-label solutions in food formulation. The section explores the increasing use of natural preservatives and innovative natural ingredients that can support food functionality, product quality, nutrition, and evolving consumer expectations.

Adding further value to this special edition are our exclusive conversations with industry leaders, offering firsthand perspectives on technology, innovation, and the evolving needs of the food and beverage sector. We speak with Mr. Srinivasan T, MD, JFM Verbruggen India Pvt. Ltd., on developments and opportunities in food processing technology; Mr. Sunil Natekar, Business Line Manager – Oil-Free Air, Compressor Technique, Atlas Copco (India) Private Limited and efficient air solutions for food and beverage applications; and Mr. Siddharth Kachroo, Head of Sales – Product Inspection India, Mettler Toledo.

Alongside these features, this edition also includes updates from our corporate happenings and sustainability segments, offering insights into industry developments, business strategies, and environmental initiatives across the food ecosystem.

We also invite you to explore more insightful articles by visiting our website at www.foodnbeveragesprocessing.com

We encourage you to continue sharing your valuable feedback with us at info@dvrpublication.com.

Wishing Anuga FoodTec, Anuga Select, all the best !!!

Thank you
Kanika Banga



www.foodnbeveragesprocessing.com



We offer Solutions, not just a product

Advanced UHT Technology for Modern Dairy Processing

Engineered for maximum shelf life and product safety, KARL SCHNELL UHT systems deliver ultra-high-temperature processing up to 145°C—ensuring reliable, high-performance results for today's demanding food industry.

Proven Expertise: Backed by decades of experience in processed cheese production, our UHT technology builds on a strong legacy of innovation and continuous improvement.

Extended Shelf Life: Achieve significantly longer product durability, enabling flexible storage, efficient logistics, and access to global markets.

Optimized Efficiency: Continuous processing ensures optimal machine utilization, stable production flows, and consistent product quality—while reducing operational costs.

Flexible Configuration: Available in capacities from 100 to 6000 kg/h, with both standard and aseptic options, our systems adapt precisely to your production needs.

Complete System Solutions: From upstream to downstream integration, every component is engineered for seamless performance—delivered from a single source.

Made in Germany: Highest engineering standards, precision manufacturing, and trusted quality you can rely on worldwide.



www.karlschnell.com



Agents in India :
Dynatech Marketing Company
Tel : +91-982 19 22 950
dynatech_marketing@yahoo.com

KARL SCHNELL
PARTNER TO THE FOOD INDUSTRY





DR. MARTINO CASTELLANI
Italian Trade Commissioner - Mumbai

Italian Trade Agency - ITA/ICE (ITA) is the Governmental agency that supports the business development of Italian companies abroad and promotes foreign investment in Italy. With a motivated and modern organization and a widespread network of overseas offices, ITA provides information, assistance, consulting, promotion and training to Italian businesses, with a special focus on small and medium-sized ones. Using the most modern multi-channel promotion and communication tools, it works to assert the excellence of Made in Italy in the world. The Italian Trade Agency in India was established in 1969 and is present with offices in New Delhi and Mumbai and a desk at the Consulate General of Italy in Bangalore.

One of the many avenues to enhance trade relations between the two countries is by showcasing opportunities that could otherwise go unnoticed. One such route is via exhibitions where we proudly display our excellence in the sector.

Italian excellence in food processing and packaging technology and machinery is world-renowned. Italian innovation and precision, together with Italian passion and craftsmanship, bring "Made in Italy" machines to the forefront on the global platform.

India's food-processing sector is estimated to reach USD 600 billion by 2030. Clearly, the sector is positioned for rapid expansion as rising consumer demand, agricultural value addition, technology, infrastructure and export opportunities transform India from a major food producer into a major global processed-food hub.

In 2025, Italy accounted for approximately 8% of India's food-processing machinery and parts imports, making it one of India's five largest foreign suppliers. India is particularly an attractive market for Italian food-processing machinery suppliers. In 2026, the Italian and Indian governments explicitly highlighted the complementarity between Italian manufacturing excellence and India's engineering talent, production scale and innovation ecosystem. They also identified machinery and agri-food among priority areas for bilateral cooperation.

We are pleased to do our bit to promote trade by combining the 'Make in India' policy with 'Made in Italy' machines. To this effect, we are here at Anuga FoodTech India 2026 from 29th September to 1st October 2026 at the Bombay Exhibition Centre, Mumbai in Hall 2 with six Italian companies that excel in food processing and packaging machinery, showcasing Italian innovation and cutting-edge technology.

We present to you the companies that are present at the show, and we invite you to visit the representatives who would be happy to converse about their machinery.

Lastly, I take this opportunity to wish all the exhibitors, delegates and visitors valuable and fruitful meetings and success.





Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 75

*From Italy
to the World*

With over fifty years of bottling engineering history since 1969, Borelli Group manufactures automatic monoblocks and complete turnkey lines.

Building on long-standing field expertise, the company delivers versatile bottling and packaging solutions tailored for a broad range of food products: Edible and olive oils, milk, dairy drinks, fruit juices, syrups, sauces, and condiments. Our product portfolio also includes integrated labeling solutions for streamlined inline packaging.



Engineered and built entirely in Italy, our machinery guarantees total container flexibility across glass and PET containers, operational reliability, easy sanitation, and maximum raw product quality preservation.



Alessandro Ivaldi
a.ivaldi@borelligroup.com

+39 393 4621443
www.borelligroup.com



*From Italy
to the World*

Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 73

PIGO SRL set as world-class leader in the design & manufacturing of high technology EFD - Sublimation Dryers, EF - IQF Fluidized bed freezers, EFS - spiral freezers, Air Dryers PG 135 & PG 128, Pitting solutions PG 103 & PG 104, as well as complete fruit & vegetables processing lines.

The perfect complexity of the high technology, simplicity for the user and economical advantage are all concentrated in EFD Easy Freeze Dryer



**FASTER
PROCESS WITH
LESS ENERGY**

Our method reduces process time up to 25% while consuming less energy up to 50%.



**LOW
TEMPERATURE
EVAPORATION**

crucially important for preserving the natural integrity of the product.



**LISTERIA &
PATHOGEN FREE
OPERATION**

Today's "must" for food safety, provided by open design of all machinery parts, as unique PIGO feature.



**NO DOWNTIME &
OPERATOR FRIENDLY
OPERATION**

All steps in the process are designed to facilitate simple, fast & efficient operation & maintenance.



**WORLDWIDE
PROVIDED
ASSISTANCE &
MAINTANANCE**
by specialized & trained personnel.



Goran Obradovic
 goran@pigo.it | info@pigo.it

+39 338 5671883
 www.pigo.it





MANN+ HUMMEL

Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 79

*From Italy
to the World*



MANN+HUMMEL Water & Membrane Solutions (WMS) is part of the MANN+HUMMEL Group a global leader in filtration technology.

WMS delivers advanced membrane and filtration technologies that enable cleaner water and fluids for a more sustainable world.

From drinking water and wastewater reuse to high-purity applications in food & beverage, dairy, pharmaceuticals, and ultrapure water production, our solutions help customers across industries achieve higher efficiency, safety, and sustainability. Driven by innovation and purpose, we work to solve the world's water and fluid challenges — making our planet safer, healthier, and more resilient.



29 SEP - 01 OCT 2026
BOMBAY EXHIBITION CENTRE, MUMBAI

 Narendra Pratap Singh

 Narendra.singh@mann-hummel.com

 +91 7795658817

 www.mann-hummel.com





Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 81

*From Italy
to the World*

Ali Group is the largest, most diversified global leader in the foodservice equipment industry.

A corporation founded more than 60 years ago, the engineering heritage and traditions of several of its companies stretch back more than 100 years and include some of the most respected names in the industry. Through its subsidiaries, the Ali Group designs, manufactures, markets and services a broad line of equipment used for commercial food cooking, preparation and processing. With 80 manufacturing sites, over 17,000 employees across 30+ countries and more than 115 brands, it gives life to the most extensive product portfolio in the industry, operating in every hospitality and catering sector.



 Michele Romano
 mromano@aligroup.com

 +39 3489691533
 www.aligroup.com



TECALIT

Pasta Plants &
Food Technologies

*From Italy
to the World*

Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 71

TECALIT, an Italian company established in 1984, manufactures and supplies machinery and complete plants for the production of pasta and snack pellets. For over 40 years, TECALIT has designed and built equipment and delivers worldwide "Turn-Key" industrial production lines.

TECALIT can supply the following fully automatic production lines:

- Short cut pasta from 300 to 9000 Kg/hour
- Long cut pasta from 300 to 6000 Kg/hour
- Gluten-Free pasta from 250 up to 3000 Kg/h
- Couscous lines up to 3200 Kg/hM
- Instant type pasta
- Multi-shape pasta lines to produce Short, Long, Nest, Lasagne, Farfalle
- Oriental Noodles
- Laminated pasta as Lasagna, Krajanka, Nitki, Wstazka and Egg Noodles
- Fresh & stuffed pasta
- Snack Pellets production lines for Die-cut, 2D Chip pellets, 3D pellets, Punched type pellets starting from 100 to 1000 Kg/hour.



TECALIT is dedicated to providing assistance to customers with highly specialized service for equipment, installation and after-sales service.



 Celeste Zanotto
 sales@tecalit.it

 +39 3423848445
 <https://www.tecalit.it/>



Visit us at the Italian Pavilion at
Anuga Food Tec India 2026: Hall 2 | Stall: A 77

*From Italy
to the World*

BMB is an Italian company with over 40 years of history, specialized in manufacturing cutting-edge vacuum packaging, MAP (modified atmosphere), and tray-sealing machines. Designed to optimize workflows through high automation, our solutions ensure maximum efficiency and continuous production, even when facing staffing shortages.



Stefano Barbieri
barbieri@bmbpack.com

+39 351 4599664
<https://bmbpack.com/en/>

Centrifugal Pumps



Estampinox

The INOXPA Estampinox is an efficient centrifugal pump designed for reliable transfer of low-viscosity liquids in hygienic applications. Its stainless-steel construction and compact design ensure dependable performance and easy maintenance.

Key Features:

- Stainless-steel hygienic construction
- Efficient & reliable operation
- Compact, easy-to-maintain design
- Suitable for continuous operation

Applications:

Dairy • Food & Beverage • Brewing • Cosmetics



Hyginox

The INOXPA Hyginox is a high-performance centrifugal pump designed for efficient and hygienic liquid transfer. It delivers smooth, reliable operation with excellent cleanability for demanding processing environments.

Key Features:

- Stainless-steel hygienic construction
- High energy efficiency
- Excellent cleanability
- Smooth product transfer

Applications:

Dairy • Food & Beverage • Pharmaceutical • Cosmetics • Brewing

INOXPA — Engineering Hygienic Process Solutions

Plant & Corporate Office (India)
INOXPA INDIA PVT LTD

Plot No. I-45A (Plot No. 6), Part of Gat No. 171 to 1/9,
Chordia Industrial Park, Village Sangavi, Naigaon,
Tal. Khandala, Dist. Satara - 412801
Maharashtra, India

inoxpa.in@inoxpa.com
020-69534000

Regional Contact No :

Solutions: 9657702709
Gujarat: 7447454528
Mumbai: 9028017921
Pune: 9552584027
Delhi: 9028017922
Bengaluru: 8380036305
Hyderabad: 8380036309



Contents



PROCESSING TECHNOLOGY

- 26 Tech-Driven Snacking: Building Healthier Products with Smarter Processing
- 30 UHT Processing in Modern Processed Cheese Manufacture
- 33 Food-safe NXD tupH® surface protection from NORD DRIVESYSTEMS
- 34 Revolutionizing Food Processing and Packaging: The Role of Robotics and Artificial Intelligence
- 38 From Formulations to Smart Lines: Bridging Ingredient Functionality and Automation in Sweets, Snacks, and Dairy
- 42 INSPECT + PROTECT: Understanding Critical Control Points for Better Contaminant Detection
- 43 Food Processing Machinery Market Set for Strong Growth as Automation Reshapes Production

PACKAGING TECHNOLOGY



- 44 Metal Cans on the Rise: How Sustainability Is Reshaping the Future of Packaging

- 48 Smart Dairy Packaging: Next-Generation Solutions for Longer Shelf Life and Food Safety
- 52 Smarter, Greener, Sustainable: The Future of Food Packaging
- 56 How Packaging Innovation is Transforming Instant Tea and Coffee Consumption

INGREDIENTS & ADDITIVES



- 57 Why the Future of Food Innovation Lies in Ingredients We Once Overlooked
- 58 Natural Food Ingredients: As Innovative solutions for food functionality
- 62 Natural Preservatives in Food: Emerging Alternatives for Clean-Label Food Products

WAREHOUSING & LOGISTICS



- 66 Cold Chain 2.0: How Smart Warehousing is Redefining Perishable Food Logistics

CORPORATE HAPPENINGS

- 68 Krones opens new plant in India
- 68 GEA expands digital portfolio in Food segment: Changeover Assist reduces errors, waste and downtime during product changeovers

Contents

- 69 EPSRR Partners with Axton Capital to Expand
F&B Concepts in Sri Lanka and Oman
- 69 Avery Dennison Inaugurates New Distribution
Centre in Bengaluru to Strengthen its 'Closer to
Customers' Commitment
- 69 Government of Odisha Signs MoU with Hindustan
Coca-Cola Beverages for Expansion of Khordha
Manufacturing Facility

SUSTAINABILITY



- 70 Amcor and Tiptree Partner on RecyClass-Certified Shrink and Stretch Films Ahead of 2027 Plastic Packaging Tax Shift
- 70 AUM Premium Partners with Scrapbuddy to Introduce Doorstep Bottle Recycling
- 71 IPL Schoeller & PureCycle Launch Off-the-Shelf Container Line, SnapPack Square EVO, Ahead of State Sustainability Mandates
- 71 American Packaging Corporation Brings Performance and Visibility to Frozen Food Packaging

NEWS & INDUSTRY UPDATES

- 20 Mogu Mogu Expands in India with the Launch of Sugar-Free Candy & Chewy Iced Tea
- 20 Heritage Foods Expands Nourish+ Portfolio with High-Protein Curd
- 21 Lay's® expands its regional innovation journey with Lay's® Hot chips style Asian
- 21 Topsy Tabby Introduces India's Refreshing take on Fruit Wine Seltzers
- 21 Aashirvaad Launches Chana Sattu across East India
- 22 Fortune Expands Mustard Oil Portfolio with New Yellow Mustard Oil



- 22 SuperYou Brings a Bolt New Take on Flavour-First Snacking With the All-New Power Puffs
- 22 PR Veteran Sowmya Iyer Launches House of Lakshyam with Traditional Spice Blends
- 24 Coca-Cola India Set to Introduce Coke Zero-Sugar Zero-Caffeine
- 24 éntisi Chocolatier Brings a Harry Potter™ Inspired Chocolate Collection to India

CORPORATE INTERACTION

**Mr. Srinivasan T, MD,
JFM Verbruggen India Pvt. Ltd.**

Stacking Up Success: JFM Verbruggen India on Building the Future of End-of-Line Automation

32



**Mr. Sunil Natekar, Business Line
Manager – Oil-Free Air, Compressor
Technique, Atlas Copco (India) Pvt. Ltd.**

50 *Powering Safer, Smarter and More Sustainable Food Production with Oil-Free Air Technology*

50

**Mr. Siddharth Kachroo, Head of Sales –
Product Inspection India, Mettler Toledo**

Precision, Safety and Smarter Inspection: Mettler Toledo's Approach to India's Food Industry

54



ARE YOU A BEVERAGE
MANUFACTURER?

A DAIRY
PROCESSOR?

A LIQUID FOOD
INNOVATOR?



drinktec India
is built for you.

Witness the technologies shaping
the future of production – **under**
one roof.

Visitor Registration is
Now Open

REGISTER NOW

drinktec
india

International trade fair for beverage,
dairy and liquid food industry

October 28-30, 2026
Bombay Exhibition Centre,
Mumbai

drinktec-india.com

Scan to Visit



For space booking :
Gaurav Wahi | +91 8433656839
gaurav.wahi@mm-india.in

Connect with us on:    

Ice Cream Tub Filling Machine

- Model RTF 10 PS

- Fills 2000 tubs/hour



We feel appreciated when national and global brand leaders select us to develop sophisticated filling machines for their food products.

Successfully developed for  **KWALITY WALL'S™**
as per HUL's international standards.



PWS ENGINEERS PRIVATE LIMITED



Celebrating 113th Year
1913-2026



D&B for D-U-N-S
No : 91-844 - 4055
Dt. May 26, 2012



Panchal Estate, Nr. Madhubhan Resort,
Anand - Sojitra Road, Anand 388 001 (Gujarat), India.



02692 - 261424 / 261716
261849 / 261948



pws@pwsengineers.com



www.pwsengineers.com

Mogu Mogu Expands Its Portfolio in India with the Launch of Sugar-Free Candy and Chewy Iced Tea

Mogu Mogu, known for its signature nata de coco "sip and chew" beverage experience, is expanding beyond beverages with new offerings in the snacking and ready-to-drink tea categories. Following the launch of Mogu Mogu Candy earlier this year, the brand is introducing Mogu Mogu Iced Tea, initially in Lemon and Peach, extending its distinctive nata de coco experience into the iced tea category. The expansion builds on Mogu Mogu's success in international markets and growing consumer affinity in India, which has emerged as one of its fastest-growing markets globally.

Mogu Mogu Candy is sugar-free, enriched with Vitamin C and contains sorbitol for a cooling effect. It is available in Lychee, Peach, Mango and Strawberry flavours, with each candy

shaped like the brand's mascot. Priced at ₹120 for a 19.5g pack, the candy is available nationwide. Mogu Mogu Iced Tea, priced at ₹60 for a 300ml pack, is launching first across South India before a national rollout. Both products will also be available through quick-commerce platforms including Blinkit and Zepto.

According to Vikash Singhal, Founder & Director, Sunbeam Mercantile Ventures, the launches are part of Mogu Mogu's strategy to become a multi-category brand in India while expanding its presence across 300+ cities, particularly Tier II and Tier III markets. The company said the new products are designed to bring its signature nata de coco experience into everyday snacking and consumption occasions, while strengthening its engagement with Gen Z and millennial consumers.



Heritage Foods Expands Nourish+ Portfolio with High-Protein Curd



Heritage Foods Limited has expanded its Nourish+ range of protein-rich dairy products with the launch of Nourish+ High Protein Curd, offering consumers a convenient way to increase their daily protein intake through a familiar dairy staple. The

new product delivers 25g of protein in a 400g pack, while retaining the creamy taste and texture associated with traditional curd. Designed for everyday consumption, the curd can be enjoyed on its own or incorporated into meals such as curd rice, raita and other preparations. The launch reflects the growing focus on protein-rich nutrition among Indian consumers. Heritage Foods believes familiar dairy products such as milk, curd and paneer can help address protein gaps in everyday diets without requiring consumers to significantly change their eating habits.

The Nourish+ portfolio is built around the idea of adding nutrition to foods consumers already enjoy. Its existing range includes Nourish+ High Protein Paneer, providing 60g of protein per 240g pack, and Nourish+ Protein Rich Milk, offering 18g of protein per 500ml pack. The addition of High Protein Curd further broadens the company's protein-focused dairy offerings.

Commenting on the launch, Brahmani Nara, Executive Director, Heritage Foods, said the company's approach is to make it easier for families to incorporate more protein into their regular diets without compromising on familiar foods and taste. She highlighted the company's growing Nourish+ portfolio as an effort to make higher-protein dairy formats more convenient and accessible. Priced at ₹75 for a 400g cup, Nourish+ High Protein Curd will be available through leading quick-commerce platforms, modern trade outlets, Heritage Happiness Points and select premium general trade stores.

Founded in 1992, Heritage Foods has established a presence across India's dairy sector, offering products including milk, curd, butter, paneer and other value-added dairy products. The company operates across 16 states and works with a network of dairy farmers, supported by quality-control processes aimed at maintaining consistency and freshness across its product portfolio. With the latest Nourish+ launch, Heritage Foods is strengthening its focus on protein-enriched everyday dairy, combining enhanced nutritional value with familiar food formats for Indian consumers.



For 13 years, we've brought the world of Food & Beverage to your table. Cheers to the next course!

www.foodnbeveragesprocessing.com

ANUGA
FOODTEC
SPECIAL

Lay's® expands its regional innovation journey with Lay's® Hot chips style Asian

Lay's®, PepsiCo India's popular potato chip brand, has expanded its regional innovation portfolio with the launch of Lay's® Hot Chips Style Asian Fieri Chilli across Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu. Developed with South Indian consumers' preference for chilli-forward flavours in mind, the new variant brings a familiar regional taste profile to a convenient packaged snack format.

The flavour draws inspiration from thin, crispy chips commonly enjoyed alongside everyday South Indian meals such as curd rice, rasam rice and lemon rice. Made from potatoes, Lay's Hot Chips Style Asian Fieri Chilli uses marination technology to deliver a crisp texture and intense chilli profile, while maintaining the brand's familiar taste and quality standards. The launch also reflects PepsiCo India's growing focus on regionalisation as a driver of product innovation. By adapting its offerings to local culinary preferences and consumption habits, the company aims to create products that



resonate with consumers while opening up new occasions beyond traditional snacking moments. The bold flavour is particularly positioned to appeal to younger consumers who are increasingly exploring intense and unconventional taste experiences.

With the new variant, Lay's continues to explore India's diverse regional palate through locally inspired innovation. By connecting traditional South Indian food preferences with modern packaged snacking, the brand is seeking to make its products relevant to both everyday meal occasions and on-the-go consumption, highlighting the growing importance of regional consumer insights in India's evolving snack market.

Tipsy Tabby Introduces India's Refreshing Take on Fruit Wine Seltzers

Tipsy Tabby has launched its range of fruit wine seltzers in India, targeting consumers seeking lighter and more mindful drinking options. Made with real fruit, the beverages contain 5% ABV and just 40 calories per bottle, offering a lighter alternative that combines fruit-forward flavour with a sparkling wine-inspired drinking experience. The range is currently available in Guava, Lime and Pineapple variants at select stores across Mumbai.

Founded by a family with generations of experience in organic farming, Tipsy Tabby was developed to create a refreshing alternative for increasingly conscious consumers. The founders spent months researching fruit-based wines before developing a beverage that combines the elegance of sparkling wine with the accessibility and lightness of a seltzer. The brand is positioned for occasions including casual brunches, social gatherings, board game nights and relaxed evenings. According to Akshay Kasbekar, Partner, Tipsy Tabby, the brand was created to make drinking lighter and more suited to



modern lifestyles without compromising on flavour or experience. Kasbekar, a second-generation farmer with an MBA in Agribusiness from Symbiosis and a WSET Level 2 certification in wines, brings together his family's agricultural background and interest in beverage innovation to develop the category.

Tipsy Tabby aims to expand its presence across India, introduce additional flavours and build awareness of fruit wine seltzers as a refreshing, low-calorie alternative. The launch comes as changing consumer preferences create opportunities for lighter and more approachable alcoholic beverage formats in India.

Aashirvaad Launches Chana Sattu Across East India



Aashirvaad strengthens its portfolio with the launch of Aashirvaad Chana Sattu across East India. The launch aligns with the brand's broader focus on building products that are naturally rich in protein and fibre, catering to the growing demand for nutritious staples without compromising on affordability or authenticity. Sattu has long been valued as a wholesome food that combines taste, satiety and nutrition. With consumers increasingly seeking foods that support healthier lifestyles, Sattu is witnessing renewed relevance as a natural source of protein and dietary fibre and because it contains essential minerals such as iron, zinc and magnesium, it is a simple, everyday nutritional choice for families.

Aashirvaad Chana Sattu is made from carefully sourced select and quality chana and prepared using the traditional sand-roasting process, which gives the distinctive roasted aroma, flavour and golden colour associated with authentic Sattu. Uniformly sand-roasted and finely ground for a smooth texture, it is suitable for a variety of traditional and everyday preparations.

Speaking about the launch, Mr. Anuj Rustagi, Chief Operating Officer, Staples and Adjacencies, Foods Division, ITC Ltd., said: "Today, consumers are increasingly looking for nutritious foods that fit naturally into their daily diet without requiring a change in eating habits. Sattu is one such food valued for its taste, versatility and nutritional goodness. With Aashirvaad Chana Sattu, we are bringing the authenticity of this cherished regional staple together with the quality and trust of Aashirvaad, making it more accessible for consumers to enjoy the benefits of sattu as part of their daily diet."

Catering to regional preferences, Aashirvaad Chana Sattu has launched two distinct variants – Chana Sattu with Jeera in Bihar and Plain Chana Sattu in West Bengal and Jharkhand.

Fortune Expands Mustard Oil Portfolio with New Yellow Mustard Oil



Fortune, the flagship edible oil brand of AWL Agri Business Ltd., has expanded its mustard oil portfolio with the launch of Fortune Yellow Mustard Oil. Available in a 1-litre PET pack, the new product is made from carefully selected yellow mustard seeds and is aimed at consumers seeking the traditional taste and cooking characteristics associated with yellow mustard oil. The new offering contains Omega-3 and Omega-6 fatty acids, catering to growing consumer interest in everyday nutrition and cooking choices. According to Prashant Pandey, Group Product Manager, AWL Agri Business, the launch reflects the company's focus on responding to changing consumer preferences while making quality edible oil products accessible to households across India.

Fortune Yellow Mustard Oil will initially be available across Delhi NCR and urban markets in Punjab and Haryana. The company plans to expand its distribution through retail outlets and quick-commerce platforms, giving consumers multiple purchasing options. The launch also strengthens Fortune's presence in the mustard oil segment and broadens its portfolio to cater to regional cooking preferences.

Representatives from retail associations across Delhi NCR attended the launch event, marking Fortune's entry into the yellow mustard oil segment. The company said the new product is part of its continued efforts to expand its presence across India's edible oil category while combining traditional consumer preferences with the Fortune brand's established positioning.

SuperYou Brings a Bolt New Take on Flavour-First Snacking With the All-New Power Puffs



SuperYou has expanded its snacking portfolio with the launch of SuperYou Power Puffs, a baked puffed snack designed to combine bold flavours with added protein. Featuring a distinctive bolt shape and light, crunchy texture, the range is positioned as a better snacking option for everyday occasions. The launch follows the success of the brand's Multigrain Protein Chips and marks its entry into the puffed snacks category.

Power Puffs is available in four flavours: Cheesy Cheese, Maaad Achari, Chilli Masala and Pizza Party. The baked, not fried snacks offer up to 13g of protein per pack

and combine familiar Indian-inspired flavours with a distinctive format. The launch is supported by the campaign "Pack Khulte Hi... Khatam, Bro!", highlighting the product's appeal among consumers seeking flavourful and convenient snacks.

According to Ranveer Singh, Co-founder, SuperYou, the range was developed around bold flavours, fun formats and an easy-to-enjoy snacking experience. Co-founder Nikunj Biyani added that consumers increasingly expect both taste and better ingredients, with Power Puffs designed to deliver familiar flavours, added protein and a distinctive shape without requiring a compromise on enjoyment. Power Puffs will be available in 33g and 55g packs through leading e-commerce and quick-commerce platforms including Amazon, Flipkart, Blinkit, Instamart and Zepto, along with select modern trade and general trade stores across major Indian cities. With the launch, SuperYou continues to expand its portfolio by reimagining familiar snack formats with added protein and baked formulations.

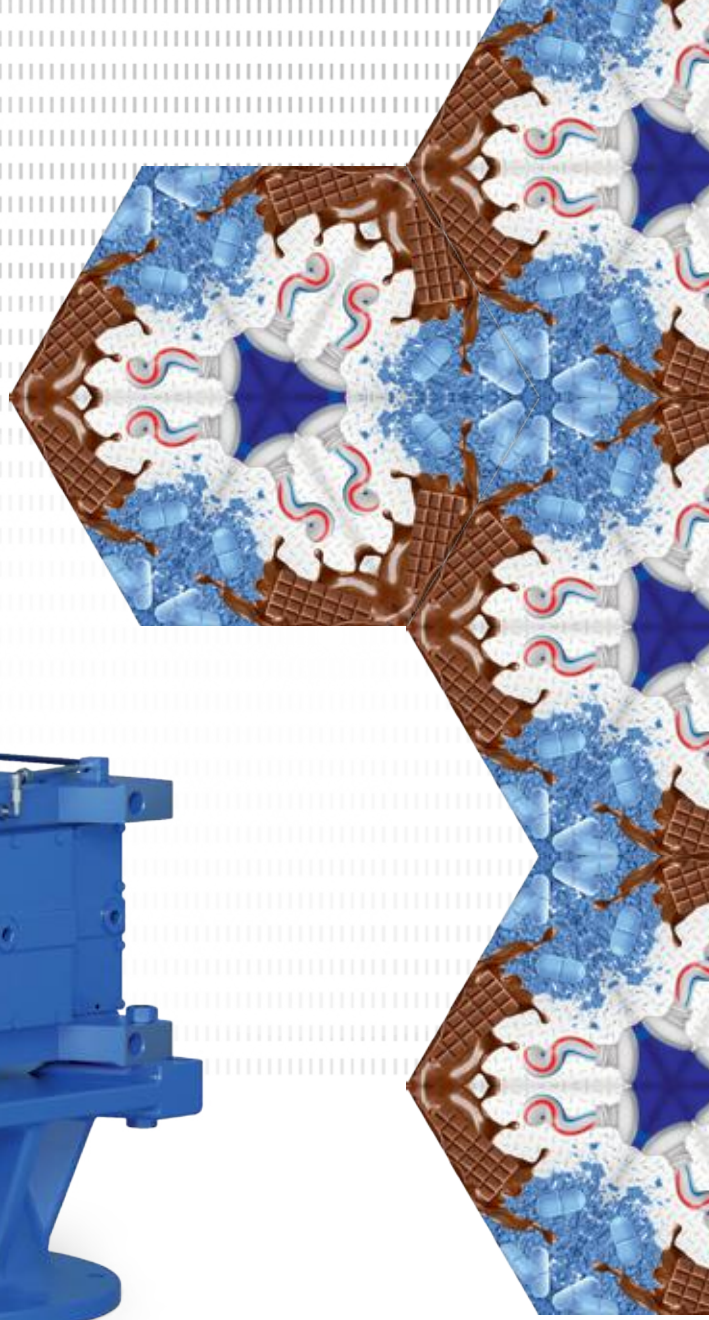
PR Veteran Sowmya Iyer Launches House of Lakshyam with Traditional Spice Blends



Public relations veteran Sowmya Iyer has officially launched House of Lakshyam, a home-grown spice brand rooted in traditional family recipes, with Idli Molaga Podi as its flagship product. The spice blend is based on a recipe passed down through three generations, from Iyer's grandmother and mother to consumers across India. The brand was created to bring authentic homemade flavours to modern households amid increasingly busy lifestyles. Here is a polished 4-paragraph, publication-ready version:

House of Lakshyam began as a three-month pilot project from April to July, during which it served 500 customers across India. Encouraged by the response and demand for traditional flavours, Iyer has now taken the venture to a full-fledged launch. The brand draws inspiration from her grandmother and mother, whose belief that no guest should leave their home without a meal forms the foundation of its philosophy around food, family and hospitality.

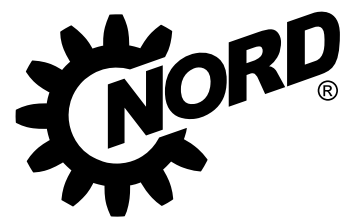
According to Iyer, House of Lakshyam was born from a desire to recreate the authentic flavours and emotional connection associated with home-cooked food. Rather than developing another packaged food label, the brand focuses on traditional preparations made with quality ingredients and the care associated with family cooking, beginning with Idli Molaga Podi prepared using her grandmother's original recipe. With Idli Molaga Podi as its first offering, House of Lakshyam is now available to consumers seeking traditional, homemade flavours for everyday meals. The brand plans to expand its portfolio in the coming months with additional recipe-led spice blends inspired by Indian culinary traditions.



Our drive solution for mixing technology

Space-saving drive systems with low maintenance costs

- ▶ Low maintenance by reducing wear parts
- ▶ Leak-proof through application-optimised product options
- ▶ Small installation space with compact housing and integrated oil tank



DRIVESYSTEMS

Our Solution. Your Success.

Coca-Cola India Set to Introduce Coke Zero-Sugar Zero-Caffeine



Coca-Cola India is gearing up to introduce its globally recognized Coke Zero-Sugar Zero-Caffeine beverage in the Indian market, with plans to manufacture the product locally. The move reflects the company's strategy to strengthen its presence in the rapidly expanding low- and no-sugar beverage segment, where consumer demand for healthier refreshment options continues to rise.

Unlike existing cola variants available in India, including Diet Coke, Coke Zero, and Pepsi,

which contain caffeine, the new offering will provide consumers with a caffeine-free alternative while retaining the brand's signature taste. The launch is expected to create a new competitive category as beverage manufacturers increasingly focus on products aligned with changing consumer preferences. The growing emphasis on ingredient transparency, clean labeling, and healthier lifestyles has accelerated demand for beverages with reduced sugar and functional benefits. Industry experts believe that introducing a zero-caffeine cola could provide Coca-Cola with an early advantage in this evolving segment, particularly if it successfully delivers on taste and consumer expectations.

The launch also aligns with broader global health trends. The World Health Organization (WHO) has highlighted that excessive caffeine consumption may contribute to sleep disturbances, anxiety, and elevated heart rate, encouraging consumers to moderate their

intake. As awareness of these concerns grows, demand for caffeine-free beverage alternatives is expected to increase.

According to industry estimates, zero- and low-sugar beverages now account for nearly 30–35% of India's soft drinks market, a significant increase from around 5% in 2020. The category has witnessed a series of launches in recent months, with several beverage companies expanding their portfolios through zero-sugar offerings to cater to health-conscious consumers.

India's soft drinks industry is also witnessing robust overall growth. Market research estimates indicate that the country's carbonated soft drinks market is projected to expand from approximately US\$15.4 billion in 2026 to US\$22.4 billion by 2033, supported by rising disposable incomes, low per capita consumption, wider product availability, and increasing competition among domestic and international beverage brands. With the planned local production of Coke Zero-Sugar Zero-Caffeine, Coca-Cola India aims to further strengthen its portfolio and capitalize on the country's fast-growing demand for healthier beverage choices.



éntisi Chocolatier today announced a collaboration with Warner Bros. Discovery Global Consumer Products to launch an officially licensed Harry Potter™ inspired premium chocolate collection in India, marking a defining moment for the country's premium chocolate industry. Inspired by some of the most beloved confectionery treats themed and iconic elements from the Harry Potter films, the collection spans Bertie Bott's Every Flavour Chocolates, Chocolate

éntisi Chocolatier Brings a Harry Potter™ Inspired Chocolate Collection to India

Frogs, Hogwarts House Chocolates, and a Platform 9 ¾ Hogwarts Express Bar.

Every product in the collection has been built to tell a story. Custom-developed moulds recreate each confectionery in exquisite detail, while the packaging draws directly from the visual world of the films. A specially designed keepsake card tucked inside every pack invites fans to build their own set – House by House, Frog by Frog echoing the nostalgia so many grew up with. It's this attention to detail, from mould to card to box, that éntisi is so proud of.

Starting at Rs. 129, the collection will be available through éntisi's own boutiques in Mumbai and Pune, its dark stores across Mumbai, Pune, Delhi, and Bengaluru, and on the éntisi website. The collection will also be exclusively available on quick commerce with Blinkit. The launch collection will be available from July 28th onwards, with celebrations building toward Harry Potter's birthday on July 31st – the moment the collection is expected to hit its stride, drawing in fandom enthusiasts, teenagers, gifting audiences, and long-time Potter fans alike.

"This collaboration is incredibly personal for

me. Like millions of people, I grew up on Harry Potter, the books and the films both. The opportunity to reimagine some of its most iconic elements from scratch, and bring them to India, is something I never imagined would become reality," said Nikki Thakker, Founder & CEO of éntisi Chocolatier. "Beyond the nostalgia, this collaboration represents a defining milestone for éntisi. In collaboration with Warner Bros. Discovery Global Consumer Products in India is a tremendous validation of the craftsmanship, quality, and ambition we've spent years building. Every mould in this collection has been custom developed exclusively for Harry Potter because we wanted every detail to feel authentic."

The collaboration also marks éntisi's formal entry into the licensed chocolate category, a strategic pillar the brand sees as a long-term growth engine. Over the coming year, éntisi plans to expand geographically with Delhi and Bengaluru as priority markets. Looking ahead, the brand's five-year vision includes a pan-India retail presence, a stronger international airport footprint, expanded quick-commerce accessibility, and new seasonal Harry Potter-inspired launches ensuring this magical journey is only just beginning.



Our Range:

Almond • Hazelnut • Pistachio • Cashew

Pure Paste • Spread • Praline Paste • Filling



ALMOND

HAZELNUT

PISTACHIO

CASHEW

PECAN

WALNUT

WINDSOR
CHOCOLATIER
— NEW DELHI —

WINDSOR CHOCOLATIER

745, Pace City II, Sector 37,
Gurugram-122001, Haryana, India

Tel: +91-124-4323975

Whatsapp : +91-9999811911

Email : windsor@windsorchocolatier.com

Website : www.windsorchocolatier.com

Tech-Driven Snacking: Building Healthier Products with Smarter Processing

From Better Nutrition to Smarter Manufacturing

Kanika Banga



The global snacking industry is entering a new phase in which consumers increasingly expect convenience, taste and nutrition from the same product. The traditional image of snacks as indulgent, high-fat and heavily processed foods is being replaced by demand for better-for-you alternatives that are lower in fat, higher in protein and fibre, and made with recognisable, clean-label ingredients. For food manufacturers, however, developing healthier snacks is not simply a matter of changing the recipe. Reducing fat, increasing protein or removing certain additives can significantly affect texture, expansion, flavour, moisture, shelf life and processing behaviour. The challenge is therefore to deliver nutritional improvements without compromising the sensory experience consumers expect.

This is where modern processing technology is becoming a critical enabler. Extrusion, precision baking, air-based frying, advanced drying, texturisation, automated seasoning and intelligent process control are allowing manufacturers to engineer snack products with greater accuracy. At the same time, robotics, sensors, machine vision and data-driven automation are helping production lines deliver consistency at higher speeds while reducing waste, energy consumption and processing variation.

Cutting Fat Without Cutting Consumer Appeal

Fat contributes significantly to flavour,

mouthfeel, crispness and overall eating experience, making fat reduction one of the most difficult challenges in healthier snack development. Simply reducing the amount of oil can produce products that are dry, tough or lacking in flavour. Modern processing systems are therefore being designed to control how ingredients interact during cooking and how the desired texture is created. Extrusion technology is one of the most versatile solutions. By precisely managing temperature, pressure, moisture and screw configuration, manufacturers can produce expanded snacks with desirable crispness while optimising the amount of added oil.

Extrusion also enables the incorporation of protein-rich ingredients, pulses and whole grains into snack formulations. Puffed cereal snacks, protein crisps and savoury bites can therefore be developed with alternative processing approaches that reduce dependence on conventional deep frying. Air frying, hot-air processing and advanced baking systems are also gaining importance. Controlled airflow, temperature and residence time allow manufacturers to achieve browning and moisture removal while significantly reducing surface oil compared with conventional frying. Automated control of these parameters becomes particularly important because even small changes in temperature or residence time can affect colour, crispness and flavour.

Engineering High-Protein Snacks

Protein has become one of the defining nutritional attributes of modern snacking. Consumers increasingly associate protein with satiety, active lifestyles and balanced nutrition, encouraging manufacturers to introduce protein-enriched bars, crisps, roasted snacks, baked savouries and extruded products. Yet increasing protein content is technically complex. Protein ingredients can influence dough behaviour, water absorption, expansion, texture and flavour. Plant proteins including pea, chickpea, lentil, soy and other pulse proteins are being incorporated into snack formulations, while whey and milk proteins continue to find applications in bars, crisps and nutritional products.

Extrusion provides an important processing platform because protein-rich raw materials can be transformed into expanded and crunchy structures. Precise management of moisture, barrel temperature, pressure and screw speed helps manufacturers balance nutritional content with expansion and texture. Co-extrusion can take this innovation further by creating products with multiple textures or fillings. This opens opportunities for protein clusters, filled crisps, savoury bites and other sophisticated snack formats that move beyond conventional chips and crackers.

Clean Label Requires Smarter Processing

Clean-label snacking is placing another layer of pressure on manufacturers. Consumers increasingly want recognisable ingredients and are paying closer attention to artificial colours, flavours, preservatives and unnecessary additives.

However, removing additives can create new technical challenges because ingredients previously used to control shelf life, colour, flavour or texture may need to be replaced by processing controls.

Gentle thermal processing, controlled roasting, baking, drying and other preservation approaches can help manufacturers reduce reliance on certain additives. High-pressure processing also has potential in selected food categories, offering shelf-life extension through relatively mild temperature treatment, although its suitability depends on the characteristics of the individual product.

Natural spices, herbs, vegetable powders, fruit concentrates and natural colours can contribute flavour and visual appeal, but these ingredients may be sensitive to heat, oxygen and moisture. Precise process monitoring can therefore become as important as formulation itself. Sensors that continuously monitor temperature, moisture and other critical parameters can help manufacturers protect ingredient quality and improve consistency.

Precision Drying: Controlling Moisture, Texture and Energy

Moisture is fundamental to snack quality. It influences crispness, microbial stability, texture and shelf life. Uneven moisture distribution can result in inconsistent products, while excessive drying can damage texture and increase energy consumption. Advanced drying systems are giving manufacturers greater control over this critical stage. Hot-air drying, vacuum drying, freeze-drying, microwave-assisted drying and hybrid technologies can be selected according to the raw material and desired product characteristics.

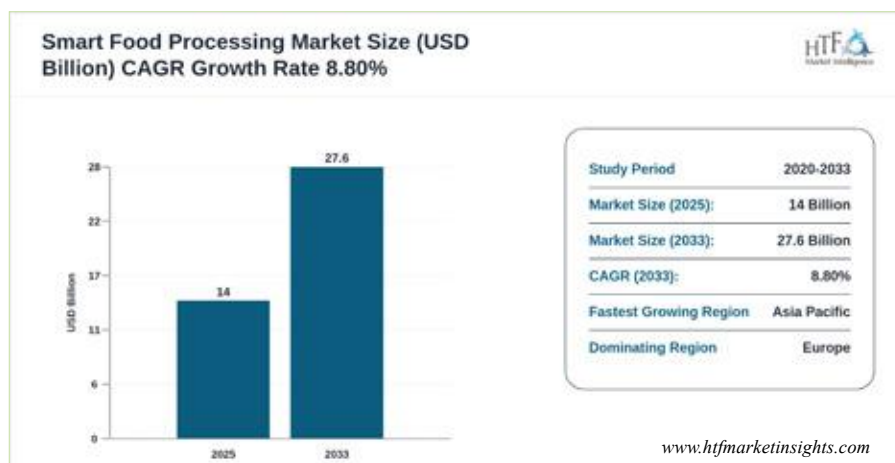
Vacuum drying, for example, operates under reduced pressure and can enable moisture removal at lower temperatures in suitable applications, helping protect heat-sensitive components. Freeze-drying can preserve the structure, flavour and nutritional characteristics of selected fruits and vegetables, creating lightweight ingredients and snack formats.

The next step is greater automation. Intelligent drying systems can use sensors and process data to monitor moisture and temperature conditions and optimise drying parameters. This can reduce over-processing, improve batch consistency and potentially lower energy consumption.

Advanced Baking and Roasting for Better-For-You Products

Roasting and baking remain important technologies for producing healthier snack formats. Modern continuous ovens and roasting systems provide precise control over temperature, airflow and residence time, allowing manufacturers to achieve consistent colour, texture and moisture levels.

Roasted chickpeas, lentils, nuts, seeds and pulse-based snacks demonstrate how familiar ingredients can be transformed into contemporary, nutrient-focused products. Controlled roasting combined with efficient seasoning can deliver crunchy products while maintaining relatively simple ingredient lists. Baking can similarly support lower-fat alternatives to fried snacks. The challenge is achieving the crispness and mouthfeel associated with fried products without relying on high levels of oil. Advanced oven design,



The Smart Food Processing market was valued at 14.00 billion in 2025 and is expected to reach 27.60 billion by 2033, growing at a compound annual growth rate (CAGR) of 8.80% over the forecast period. Smart Food Processing Market integrates digital technologies such as IoT sensors, artificial intelligence, and advanced analytics into traditional food manufacturing systems. It enables real-time monitoring, predictive maintenance, and automated quality control across processing lines. The market enhances operational efficiency, reduces downtime, and ensures regulatory compliance. Increasing adoption of Industry 4.0 principles and demand for traceability drive growth. However, cybersecurity risks and integration with legacy infrastructure remain major concerns.
www.htfmarketinsights.com

airflow management and precise temperature control are helping manufacturers address this challenge.

Automation Makes Seasoning More Precise

Seasoning is another area where automation can contribute directly to healthier product development. Traditional seasoning processes can result in uneven coating, which may force manufacturers to use more oil, flavouring or seasoning to ensure that every product delivers the desired taste.

Automated seasoning and coating systems can provide more uniform distribution across the product surface. Precise control of powder flow, oil application, drum speed and product throughput can improve consistency while helping manufacturers optimise ingredient usage. For large-scale snack producers, automated systems can also reduce manual intervention and improve production efficiency. Recipe management and automated changeovers can allow manufacturers to switch between products

while maintaining tighter control over formulation and processing parameters.

Robotics and Machine Vision Enter the Snack Line

The transformation toward healthier snacks is taking place alongside a broader shift towards automated food manufacturing. Robotics and machine vision are increasingly becoming part of modern snack production lines, particularly in handling, sorting, inspection, packing and palletising operations.

Robotic systems can automate repetitive handling tasks while maintaining speed and consistency. In packaging operations, robots can handle products, cases and finished packs at high throughput, reducing dependence on manual labour for repetitive activities.

Machine vision adds another layer of quality control. Cameras and vision systems can inspect products for colour variation, shape, size, surface defects and other visible inconsistencies. When integrated with automated rejection systems, defective products can be removed from the line without interrupting production. For manufacturers producing clean-label and premium healthy snacks, this level of control is increasingly valuable because product consistency is closely linked to consumer perception of quality.

Digital Process Control Turns Production Data into Intelligence

Automation becomes even more powerful when combined with real-time data. Sensors can continuously monitor variables such as temperature, pressure, moisture, airflow and product characteristics. This information can then be used by control systems to adjust processing conditions and minimise variation.

For high-volume snack production, digitalisation can improve traceability and operational efficiency while helping

manufacturers identify equipment inefficiencies and abnormal operating conditions. Production data can also support predictive maintenance by identifying patterns that indicate potential equipment problems before they lead to unexpected downtime. This is particularly important for healthier snack formulations, which can be more sensitive to changes in moisture, protein levels and processing conditions. A small variation in extrusion temperature, for example, can affect expansion and texture. Digital control helps manufacturers maintain the narrow processing window required for consistent results.

IoT, AI and Analytics Bring Intelligence to Snack Processing

The integration of IoT sensors, artificial intelligence (AI) and advanced analytics is taking snack manufacturing beyond conventional automation towards intelligent, connected production.

IoT-enabled sensors installed across processing equipment can continuously capture data on temperature, pressure, moisture, airflow, energy consumption, equipment performance and other critical parameters. AI and advanced analytics can then analyse this data to identify process deviations, predict equipment failures and recommend adjustments before quality or productivity is affected.

In modern snack processing, this can help manufacturers maintain consistent expansion, crispness, colour and moisture levels while reducing raw-material losses and energy consumption. AI-driven systems can also analyse historical production data to identify optimal processing conditions for different formulations, including low-fat and high-protein products that may require tighter process control. When connected with automated equipment, these technologies can enable real-time decision-making, predictive maintenance and more responsive production lines. The result is a smarter snack factory where machines do not simply perform predefined tasks but increasingly sense, analyse, learn and respond, helping manufacturers achieve greater consistency, efficiency and flexibility.

New Texture Technologies Expand the Healthy Snack Opportunity

Texture remains one of the biggest barriers to consumer acceptance of healthier snacks. Consumers may be interested in a product because of its nutritional profile, but repeat purchase ultimately depends heavily on eating experience. This has encouraged

manufacturers to explore extrusion, aeration, texturisation, high-moisture processing and structured ingredient systems. Protein-rich ingredients can be engineered into fibrous, crunchy or expanded structures depending on the desired application.

Combining grains, pulses, seeds and different protein sources can also create multi-textural products. The result is a broader range of formats, including protein clusters, nutritional crisps, savoury bites and functional snacks. Technology is therefore moving healthy snacking beyond the simple concept of removing undesirable

defined by one breakthrough technology. Instead, it will depend on how formulation science, processing equipment, automation, robotics, digital systems and packaging technologies work together.

A modern snack production line can increasingly be viewed as an integrated system: sensors monitor critical parameters, automated equipment adjusts processing conditions, extrusion and texturisation technologies create the desired structure, precision baking or drying controls moisture, automated seasoning optimises flavour delivery, machine vision checks product quality, and robotic systems handle finished products and packaging. This integrated approach can help manufacturers address several challenges simultaneously, including lower fat levels, higher protein content, cleaner formulations, consistent texture, reduced waste and improved operational efficiency.

Building the Next Generation of Better-For-You Snacks

Consumers are increasingly unwilling to choose between health and enjoyment. They expect snacks to offer nutritional value without sacrificing taste, texture, convenience or affordability. For manufacturers, meeting these expectations requires a shift from conventional recipe-based product development towards technology-driven food engineering.

Extrusion, advanced baking, air-based frying, precision drying, texturisation and automated seasoning are already creating new possibilities for healthier formulations. Robotics, machine vision, sensors and digital process control are adding another layer of precision and efficiency, while advanced packaging helps preserve quality throughout distribution and storage.

The next generation of snacks will therefore be shaped by smarter manufacturing as much as by new ingredients. The competitive advantage will belong to manufacturers capable of integrating nutrition, sensory performance, automation and process efficiency into a single production strategy.

As these technologies continue to develop, healthy snacking is moving beyond a niche consumer trend. It is becoming a major innovation opportunity for the food industry, with smart processing and automation providing the technological foundation for snacks that are healthier, cleaner, more consistent and still enjoyable to eat.



ingredients. Manufacturers are increasingly engineering the structure of the product itself.

Smart Packaging Completes the Processing Chain

Processing technology cannot guarantee snack quality throughout the product's shelf life. Packaging plays a critical role, particularly when products contain fewer preservatives or have carefully controlled moisture levels. Moisture and oxygen can quickly affect crispness, flavour and nutritional quality. High-barrier films, modified-atmosphere packaging and effective sealing technologies can provide protection against these factors.

Automation is also transforming packaging operations. Automated filling, weighing, sealing, inspection, case packing and palletising systems can improve throughput and consistency while reducing product handling. Inline inspection technologies can further verify package integrity and help identify sealing or filling problems before products leave the facility. For clean-label products, the combination of smart processing and effective packaging becomes especially important because manufacturers may have less reliance on preservatives to maintain shelf life.

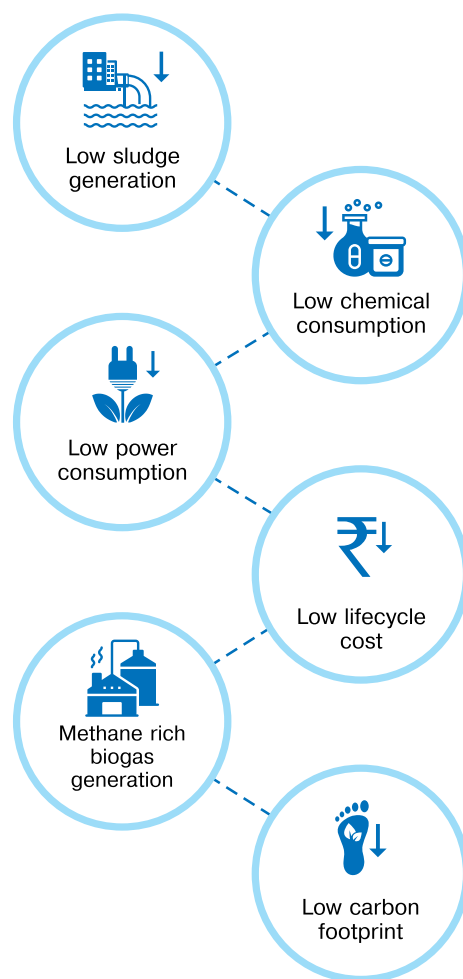
The Future Is an Integrated Smart Snack Factory

The future of healthy snacking will not be

Smart sustainable solutions for F&B industry wastewater treatment

Expertise in handling complex wastewaters from many different industry segments including dairy, agro, and food and beverages

Benefits



Offerings

- Primary treatment
- Secondary (anaerobic/anoxic/aerobic) biological treatment
- MBR/RO/recycling
- MEE/ZLD
- Sludge thickening and sludge dewatering
- Solar sludge drying

Some of our customers:



A.T.E. HUBER Envirotech Private Limited

(A joint venture of A.T.E., India and HUBER SE, Germany)
T: India (toll free) 1800 123 2830, International +91 83568 53561
E: wwtp@atehuber.com
W: www.atehuber.com, www.ategroup.com
CIN: U74999MH2000PTC127595



Scan to WhatsApp



UHT Processing in Modern Processed Cheese Manufacture



The history of processed cheese is closely linked to one of the most important objectives in dairy technology: improving microbiological stability while maintaining product quality. When processed cheese first emerged on an industrial scale in the early twentieth century, thermal treatment provided manufacturers with a reliable means of extending shelf life and improving product consistency. Over time, growing demands for food safety, global distribution, and production efficiency drove the development of increasingly advanced heat-treatment technologies.

While conventional pasteurization remained the industry standard for many years, the need for longer shelf life and greater microbiological security eventually led to the adoption of ultra-high-temperature (UHT) processing. Today, UHT technology has become an established solution to produce shelf-stable processed cheese.

In dairy processing, UHT treatment typically involves heating a product to temperatures between approximately 130 and 150°C for a very short period, followed by rapid cooling. Originally developed for liquid dairy products, the technology enables a substantial reduction of microorganisms while minimizing unwanted thermal effects on flavour and functionality. The result is a product with significantly extended shelf life

and a high level of microbiological safety.

Applying this principle to processed cheese, however, is considerably more complex than in liquid milk processing. Processed cheese formulations cover a wide viscosity range and consist of interacting proteins, fat, water, and emulsifying salts. Throughout the thermal process, these components must remain under precise control to achieve the desired texture, meltability, firmness, and sensory properties. Heating intensity, residence time, mixing efficiency, and cooling conditions all play a critical role in determining final product quality.

For decades, KARL SCHNELL has specialized in

developing technologies for these demanding applications. Following the introduction of some of the first fully automated processed cheese production systems in the 1970s, the company continuously expanded its expertise in thermal processing. Over the past twenty years, UHT technology has become a core competence, supported by extensive experience in both industrial production and product development environments.

One of the key challenges in UHT processing is achieving highly efficient heat transfer without compromising product quality. KARL SCHNELL addresses this through direct steam injection systems adapted to the specific product requirements. Direct steam injection enables rapid and uniform heating while reducing thermal stress compared with longer indirect heating processes. Dynamic, static, or high-shear mixing systems ensure homogeneous distribution of thermal energy throughout the product mass and provide reliable process reproducibility across a broad range of formulations.

From a production perspective, continuous UHT processing offers significant advantages. Modern dairy plants are expected to deliver consistent product quality over extended production campaigns while maintaining strict food safety standards. Continuous systems provide greater process stability than batch-based concepts, as critical parameters such as temperature, pressure, flow rate, and holding time can be monitored and controlled in real time. This ensures reproducible product characteristics from the beginning to the end of a production run.

The benefits of UHT technology extend beyond product safety and quality. Extended shelf life creates greater flexibility throughout the supply chain, allowing manufacturers to produce larger volumes, optimize inventory management, and improve utilization of production capacity. It also opens opportunities for export markets, as products can withstand longer transport and storage



periods without compromising quality. For many manufacturers, these logistical advantages have become a decisive factor in production planning.

Energy efficiency has also become a central consideration in modern dairy processing. As thermal treatment is among the most energy-intensive operations in food manufacturing, advanced UHT systems increasingly incorporate heat recovery technologies that reuse thermal energy within the process. This reduces overall energy consumption while maintaining high process performance and contributes to both lower operating costs and improved sustainability.

Equally important is hygienic plant design. Modern UHT installations must comply with stringent international hygiene standards and support validated cleaning and sterilization procedures. Fully integrated CIP (Cleaning-in-Place) and SIP (Sterilization-in-Place) capabilities have therefore become essential features. Automated monitoring and documentation of critical process parameters additionally support quality assurance programs and provide the traceability required by customers, auditors, and regulatory authorities.

The KS Heating System UHT was developed specifically to meet these requirements. Available in capacities ranging from pilot-scale units for research and development to high-capacity industrial installations, the system combines direct steam heating, advanced process control, hygienic design, and intelligent energy management within a continuous production environment. A distinctive feature is the use of two independent heating circuits, allowing flexible production planning while maintaining high plant availability and operational efficiency.

Today, successful UHT processing can no longer be viewed simply as a heat-treatment step. It has evolved into a comprehensive process-engineering discipline that combines microbiology, thermodynamics, rheology, automation, and hygienic design. As expectations regarding food safety, shelf life, and production efficiency continue to increase, UHT technology remains one of the key enabling technologies in modern processed cheese manufacture. With decades of experience in dairy and processed cheese processing, KARL SCHNELL continues to contribute to this development through systems designed to balance product quality, process reliability, and economic efficiency.

KARL SCHNELL GmbH & Co. KG
D-73650 Winterbach +49 (0) 7181/962-115
marketing@karlschnell.de
www.karlschnell.de

SUBSCRIPTION FORM



By Subscribing to FBP magazine, you are helping us to fulfil our mission to inspire and deliver technology based information worldwide....

Date :

Place:



FOOD & BEVERAGES PROCESSING MAGAZINE
Frequency / Monthly | Cover Price - Rs. 300 /- Only

Full Name:

Company Name :

Address :

Pincode : **Mobile No:**

Email Id:

GST No. : (If Any)

Magazine Type	6 Months	1 Year	2 Years	3 Years
Print	Rs. 1500	Rs. 3000	Rs. 6000	Rs. 9000
e-Magazine	Rs. 600	Rs. 1000	Rs. 1500	Rs. 2000

PAYMENT DETAILS (RTGS/NEFT)

Beneficiary Name : DVR PUBLICATION PVT LTD
Account No - 50200006029203 /
Beneficiary's Bank - HDFC BANK LTD
Bank Add: HDFC BANK LTD,
Mayur Vihar Phase - 2, Delhi - 91
Branch code : 0293
IFS code : HDFC0000293
MICR code :110240042
Company PAN No:AAFC0344Q
GST No. : 07AAFC0344Q1ZG



DVR PUBLICATION PVT. LTD.

Adds.: D-101, Gazipur, Near Lavin International school, Delhi-110096

Phone : +91 - 9555837771 / 9555837779 / 9999383836

Email Id: info@dvrpublication.com / foodandbeveragesprocessing@gmail.com

Web: www.foodnbeveragesprocessing.com



**Mr. Srinivasan T, MD,
JFM Verbruggen India Pvt. Ltd.**

JFM Verbruggen India Private Limited is the Indian arm of Verbruggen Palletizing Solutions, a Dutch specialist in end-of-line palletizing technology. Founded in the Netherlands in 1991 and now approaching its 35th year, Verbruggen has grown into a global company with more than 2,400 installations worldwide, a new headquarters in Emmeloord, and branch offices across the United States, India and Argentina. In India, under the leadership of Managing Director Srinivasan T, the company serves the agriculture, food, feed and non-food manufacturing sectors. In this interview, he outlines the company's capabilities, its approach to customisation, and its priorities for the Indian market.

JFM Verbruggen combines Dutch palletizing expertise with its presence in India. Could you briefly explain the company's core capabilities and the end-of-line solutions it currently offers to Indian industries?

Verbruggen's story began in 1991, when two Dutch brothers built a machine to automatically stack bags of seed potatoes. That same practical, engineering-first approach still defines us today. Everything — design, software, assembly and after-sales support — is handled in-house, which is what lets us guarantee consistency from our Netherlands headquarters. For Indian

Stacking Up Success: JFM Verbruggen India on Building the Future of End-of-Line Automation

Mr. Srinivasan T, Managing Director of JFM Verbruggen India Private Limited, speaks to Food & Beverages Processing Magazine about the company's palletizing technology, its approach to customisation, and its plans for the Indian market.

manufacturers, our core offering spans the complete end-of-line journey: the V-Stack series of box, carton and crate palletizers; the VPM-5 for compact bag palletizing; the V-Weigh, V-Load and V-Pack systems that weigh, place and bag product before it ever reaches the palletizer; and a full range of wrapping machines that secure the finished pallet for transport. In short, whatever an Indian plant needs to stack — bags, boxes, cartons, crates or wraps — we have a machine engineered to do it reliably, every single time.

What makes Verbruggen's palletizing systems different from conventional end-of-line automation solutions in terms of design, flexibility, reliability, and operating efficiency?

Our philosophy is one strong, proven platform with multiple performance tiers, rather than a one-size-fits-all machine. The V-Stack range, for instance, scales from a compact entry-level unit suited to tight floor space, up to a high-speed system capable of handling more than 80 – 100 boxes a minute — so a customer never overpays for capacity they don't need, nor compromises on capacity they do. On reliability, we lean on direct drum-motor drives, dual-magazine bag placers that can be refilled without halting the line, and intelligent touchscreen software that flags problems early. Many of our machines run daily for over 25 years, and remote diagnostics mean our service team can often resolve an issue before it ever becomes downtime. That combination of modularity, robust build, and remote support is what genuinely sets us apart from conventional automation suppliers.

Verbruggen serves agriculture, feed, food, and non-food industries. How does the company customise its palletizing solutions to meet the different handling and production requirements of these sectors?

Customisation isn't an add-on for us — it's

built into how every machine is designed. Our palletizers use configurable stacking patterns that operators can adjust themselves or that our service team can update remotely, and on the hardware side we offer options such as centering flaps for narrow bags, extra collar sections to speed up changeovers between pallet sizes, and a choice of pallet transport methods. That flexibility matters because the requirements genuinely differ: agriculture and feed customers often need to handle heavier, bulkier bags of grains, seeds or fertilizer; food and snack manufacturers need gentler handling for cartons and delicate packaging; non-food industries bring their own footprint and throughput constraints. To make sure every customer gets the right configuration, we also offer a free Stack Check — a one-hour advisory session in which our specialists review a plant's current process and pinpoint exactly where a tailored solution adds the most value.

How does Verbruggen integrate robotics, automation, and intelligent controls into its palletizing systems to improve line speed, accuracy, and overall plant productivity?

Every Verbruggen system is built around intelligent, touchscreen-driven controls and configurable stacking-pattern software that keep placement accurate at speed, with our fastest V-Stack models running at more than 80 boxes a minute. Ahead of the palletizer, our V-Weigh, V-Load and V-Pack systems automate weighing, bag placement and bagging itself, turning what used to be several manual steps into one continuous, hands-off flow from empty bag to fully stacked, wrapped pallet. Remote access technology lets our engineers monitor and diagnose machines from anywhere, which keeps unplanned stoppages to a minimum. Together, this level of automation and intelligent control is what allows Indian plants to scale up throughput without having to scale up their labour dependency in the same proportion.

For Indian manufacturers, investment cost and return on investment are important considerations. How does Verbruggen help customers evaluate the business case for automating their end-of-line operations?

We start with the free Stack Check advisory session, where we assess a customer's existing process before recommending any equipment — the goal is a solution sized to their actual need, not an oversold system. Our machines are engineered for a strong return on investment, typically within two to three years, which comes from a combination of factors: reduced labour dependency, fewer product-damage losses from more stable stacks, low-maintenance construction that keeps service costs down, and machines built to run reliably for decades rather than years. We also back every installation with spare-parts kits, operator training, and a customer portal with full manuals, so the total cost of ownership stays predictable long after the initial investment.

What has been the market response to Verbruggen's solutions in India, and which industries or applications are currently showing the strongest demand for automated palletizing?

The response from Indian manufacturers has been genuinely encouraging, and it mirrors what we are seeing across the food processing sector more broadly. Government-backed growth — through schemes such as the Production Linked Incentive Scheme for Food Processing Industry and the PM Formalization of Micro Food Processing Enterprises scheme — is pushing processors to scale up capacity quickly, and manual, labour-intensive stacking simply cannot keep pace with that growth on speed, consistency, or worker safety. We are seeing the strongest interest from agriculture-linked processing — potatoes, onions, grains and seeds — alongside food, snacks and confectioning, and pet food and animal feed manufacturers, all of whom are under pressure to modernise their end-of-line operations to match upstream investments in production capacity.

As manufacturers move towards smart factories and increasingly automated production lines, what are JFM Verbruggen India's key priorities for technology development, localisation, and market expansion in India?

India's growth trajectory is a natural fit for the kind of reliable, high-throughput, low-maintenance palletizing technology we have spent more than three decades perfecting, and our priorities reflect that. On technology, we will keep building on our intelligent controls, remote diagnostics, and configurable software so our systems slot easily into increasingly connected, smart-factory environments. On localisation, our focus is on strengthening service and support infrastructure on the ground in India, so customers get the same fast, hands-on response that has defined Verbruggen globally. And on market expansion, we intend to deepen our presence across agriculture, food, pet food and non-food manufacturing as Indian processors continue to invest in capacity — because as that capacity grows, dependable end-of-line automation stops being optional and becomes essential.

Food-safe NXD tupH® surface protection from NORD DRIVESYSTEMS

Aluminium drives become "tough" against cleaning chemicals

With NXD tupH® from NORD DRIVESYSTEMS, users of hygiene-sensitive applications in food & beverage and primary packaging industries can benefit from the strengths of aluminium drive solutions. The food-safe surface treatment provides aluminium with properties that make the material comparable to stainless steel in terms of hygiene and corrosion resistance.

With NXD tupH®, NORD DRIVESYSTEMS has developed an effective and food-safe surface protection especially for aluminium housings. The respective gear units, smooth motors and decentralised frequency inverters become particularly corrosion-resistant and withstand extensive cleaning procedures in food processing industries over the long term. NXD means "NORD eXtreme Duty"; tupH combines the English terms "tough" and "pH-value".

Test prove chemical resistance

NXD tupH® combines a special surface treatment with a high-performance sealer. The result is a non-porous surface that can be cleaned hygienically and neither flakes off nor corrodes after numerous cleaning cycles. NXD tupH® has proven its chemical resistance in a long-term test, including the use of Ecolab cleaning agents. NORD drive components with NXD tupH® surfaces are furthermore food-safe in accordance with the requirements of the FDA, EU and Switzerland as well as the MERCOSUR states. They are suitable for food-contact applications in the fields of food & beverage and primary packaging.

Economical alternative to stainless steel drives

With this, NORD provides users with an economical and powerful alternative to stainless steel drives. Drive solutions with aluminium housings are more



NORD-NXD-tupH.jpg: The food-safe NXD tupH® surface protection makes NORD drive systems with aluminium housings more resistant to cleaning chemicals

lightweight and allow for compact design. Since aluminium dissipates heat well, a higher power density and lower surface temperatures can be achieved. With NXD tupH®, aluminium housings now also become chemical-resistant, making the drive solutions durable and increasing the system availability in wash-down applications.

The surface protection from NORD does not require any special design and thus no separate warehousing and installation costs. The manufacturer applies its surface treatment to existing components. This way, it can use the options of its modular products for the drive system design, and supply tailor-made NXD tupH® drive systems completely from a single source.

NXD tupH®-treated complete solutions from a single source

NXD tupH® is available for all NORD aluminium products with a smooth surface, including the integrated DuoDrive gear unit / motor system, the energy-efficient IE5+ smooth motors as well as NORDBLOC.1® helical in-line gear units and NORDBLOC.1® helical bevel gear units. Furthermore, with NORDAC ON PURE, a decentralised frequency inverter with NXD tupH® surface will be available soon. Solution provider NORD can thus supply complete drive systems with food-safe surface treatment from a single source.

NORD DRIVESYSTEMS | www.nord.com



Revolutionizing Food Processing and Packaging: The Role of Robotics and Artificial Intelligence



Dr. G. Pandidurai



Dr. AASIF. M



Dr. M.P. Brindhavani

ensuring consistent product quality and food safety.

Robotic systems have become particularly valuable in handling repetitive, labour-intensive, and hygienically sensitive operations. Unlike manual processing, robots can operate continuously with high accuracy, minimize product contamination, reduce food waste, improve worker safety, and optimize production efficiency. Their ability to adapt to different food products through AI-enabled vision systems and programmable automation makes them increasingly attractive for industries processing fruits, vegetables, meat, dairy, bakery products, seafood, beverages, and ready-to-eat foods.

Furthermore, the emergence of collaborative robots, intelligent quality inspection systems, and autonomous packaging lines is reshaping the future of food manufacturing. These innovations not only improve operational efficiency but also help food industries address labour shortages, comply with increasingly stringent food safety standards, and meet growing consumer expectations for high-quality products. As automation becomes more accessible and cost-effective, robotics is expected to play a central role in building sustainable, resilient, and smart food processing systems worldwide.

What is Food Robotics?

Food robotics refers to the application of advanced robotic systems across various stages of the food supply chain, from raw material handling to the distribution of finished products. These intelligent machines are designed to automate a wide range of operations, including food preparation, processing, sorting and

grading, quality inspection, packaging, palletizing, warehousing, and logistics. Unlike conventional industrial robots, food-grade robotic systems are specifically engineered to meet stringent hygiene, sanitation, and food safety standards, enabling them to handle delicate and perishable food products with exceptional precision, speed, and consistency. By automating repetitive and labour-intensive tasks, food robotics enhances production efficiency, reduces operational costs, improves product uniformity, and minimizes the risk of contamination.

Modern food robotic systems are integrated with cutting-edge digital technologies such as Artificial Intelligence (AI), Machine Learning (ML), Computer Vision, Machine Vision, advanced sensors, and the Internet of Things (IoT), enabling them to perform intelligent and adaptive manufacturing operations. These technologies allow robots to identify food products, detect defects, assess quality, recognize variations in size, shape, colour, and orientation, and make real-time decisions during processing and packaging. Furthermore, AI-powered robotic systems continuously learn from production data, optimizing performance, improving operational accuracy, and supporting predictive maintenance. The convergence of robotics with Industry 4.0 technologies is transforming conventional food processing facilities into smart manufacturing systems capable of producing safer, higher-quality, and more sustainable food products with greater flexibility and efficiency.

Applications of Robotics in Food Processing and Packaging

The food processing industry employs robotic systems across multiple stages of production

Introduction

The global food industry is undergoing a rapid technological transformation driven by automation, artificial intelligence (AI), and robotics. Rising consumer demand for safe, high-quality, and conveniently packaged food, combined with increasing labour shortages, stringent food safety regulations, and the need for higher production efficiency, has accelerated the adoption of robotic technologies across the food processing and packaging sectors. Today, robots are no longer confined to automobile manufacturing; they are becoming integral components of modern food factories, performing tasks ranging from sorting and grading to cutting, packaging, palletizing, and quality inspection with exceptional speed and precision. The global food robotics market reflects this rapid growth. Recent market analyses estimate that the industry was valued at approximately USD 2.7 billion in 2025 and is projected to reach nearly USD 15 billion by 2034, expanding at a compound annual growth rate (CAGR) of about 20.9%. This remarkable growth is fuelled by technological advancements in machine vision, artificial intelligence, collaborative robots (cobots), and the Internet of Things (IoT), enabling food manufacturers to enhance productivity while

to enhance operational efficiency, ensure product consistency, improve food safety, and reduce labour dependency. Equipped with advanced technologies such as artificial intelligence (AI), machine vision, force sensors, and precision control systems, food-grade robots perform complex operations with high accuracy and repeatability. Major applications of robotics in food processing and packaging are discussed below.

1. Automated Sorting and Quality Grading

Sorting and grading are among the earliest and most widespread applications of robotics in the food industry. Modern robotic systems integrated with machine vision and artificial intelligence can rapidly inspect food products based on physical and visual characteristics, including size, shape, colour, weight, ripeness, and surface defects. These systems are extensively used for grading fruits, vegetables, meat, seafood, grains, eggs, and bakery products. Advanced image-processing algorithms enable robots to identify bruises, cracks, discoloration, contamination, and other quality defects that may not be consistently detected through manual inspection. Defective or substandard products are automatically rejected, while premium-quality products are directed to appropriate processing or packaging lines. This automated approach improves grading accuracy, enhances product uniformity, reduces post-harvest losses, and significantly increases processing speed.

2. Precision Cutting and Portioning

Robotic cutting systems have transformed food preparation operations by delivering highly accurate and consistent cutting, slicing, trimming, and portioning. These systems are widely employed in meat deboning, fish filleting, poultry processing, cheese slicing, vegetable cutting, and fruit peeling operations.

Using three-dimensional imaging, laser scanners, and intelligent sensing technologies, robots can automatically determine the size, shape, and orientation of each product before executing precise cutting patterns. This capability minimizes raw material wastage, maximizes product yield, and ensures uniform portion sizes that meet commercial quality standards. In addition, robotic cutting systems improve worker safety by reducing direct exposure to sharp cutting equipment and repetitive manual tasks.

3. High-Speed Pick-and-Place Operations

Pick-and-place operations represent one of the most successful applications of industrial robotics in food manufacturing. High-speed Delta robots are specifically designed to handle lightweight and delicate food products



High Speed Packing of Frozen Fish



Picking & Packing Salami Snacks



Packing cheese



Packing baked foods

MAJOR CHALLENGES IN THE ADOPTION OF FOOD ROBOTICS			
Overcoming Challenges Today for a Smarter, Safer and Sustainable Food Industry Tomorrow			
CHALLENGE	DESCRIPTION	POTENTIAL IMPACT	
High Initial Investment	Significant capital is required for robotic equipment, installation, and infrastructure upgrades.	Limits adoption, particularly among small and medium-sized enterprises (SMEs).	
Integration with Existing Production Lines	Existing processing facilities may require redesign or modification to accommodate robotic systems.	Increased implementation time, production interruptions, and additional costs.	
Variability of Food Products	Natural variations in size, shape, texture, and moisture content make robotic handling more complex.	Reduced operational efficiency and the need for advanced sensing and AI technologies.	
Requirement for Skilled Personnel	Operation, programming, maintenance, and troubleshooting require trained technical professionals.	Increased training costs and shortage of skilled workforce.	
Maintenance and Software Updates	Robotic systems require routine maintenance, calibration, and periodic software upgrades.	Equipment downtime and higher maintenance expenditure if not properly managed.	
Cybersecurity Risks	Connected robotic systems and smart factories are vulnerable to cyberattacks and unauthorized access.	Data breaches, production disruptions, and potential food safety risks.	
Regulatory and Food Safety Compliance	Robotic systems must comply with stringent hygiene, sanitation, and food safety standards.	Additional validation, certification, and compliance costs.	
Limited Adoption by SMEs	Financial constraints and lack of technical expertise hinder implementation in smaller enterprises.	Slower digital transformation and reduced competitiveness.	

WAY FORWARD

- Financial support and incentives for SMEs
- Skill development and technical training
- Innovation in affordable and user-friendly robotic solutions
- Stronger cybersecurity and data protection measures
- Supportive policies and industry-academic collaboration

Addressing these challenges will accelerate the adoption of food robotics and build a resilient, efficient and future-ready food industry.

with exceptional speed and precision. These robotic systems are extensively used for handling chocolates, biscuits, confectionery, bakery products, dairy items, fresh fruits, vegetables, and ready-to-eat food products. Equipped with advanced vision systems and soft grippers, Delta robots can identify randomly positioned products on conveyor belts, orient them correctly, and transfer them into trays, cartons, or packaging containers without causing physical damage.

4. AI-Based Quality Inspection and Food Safety Assurance

Quality inspection is one of the most critical

stages in food processing, where robotic systems equipped with artificial intelligence (AI), machine vision, and high-resolution cameras ensure that only products meeting quality standards reach consumers. These intelligent systems continuously inspect food products and packaging for foreign materials, surface defects, discoloration, improper dimensions, damaged packaging, missing labels, incorrect labeling, and seal integrity. Unlike manual inspection, robotic systems operate with high speed and consistency, minimizing human error while accurately detecting even minor defects in real time.

The integration of AI enables robotic inspection systems to learn from production data and improve defect detection over time. Products that fail to meet predefined quality specifications are automatically rejected, thereby reducing recalls and preventing unsafe products from entering the market. Automated quality inspection also supports compliance with food safety standards such as HACCP, ISO 22000, GMP, and FSSAI regulations. Furthermore, these systems improve traceability, enhance consumer confidence, reduce operational costs associated with quality control, and contribute to the production of safe, high-quality food products.

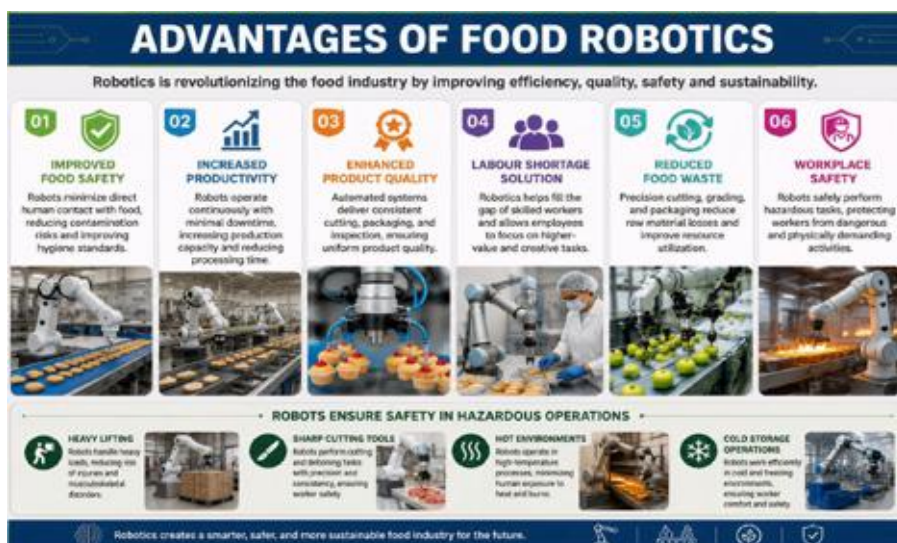
5. Robotic Food Packaging and Intelligent End-of-Line Automation

Food packaging is one of the fastest-growing applications of robotics, as manufacturers seek higher production efficiency, improved hygiene, and greater flexibility in packaging operations. Modern robotic packaging systems perform a wide range of tasks, including product arrangement, container filling, tray loading, wrapping, sealing, labeling, carton packing, case packing, and palletizing. Vision-guided robots precisely position products within packages, ensuring consistent presentation while minimizing product damage and reducing packaging material waste. Their ability to handle products of varying sizes, shapes, and packaging formats makes them highly suitable for modern food manufacturing environments.

Unlike conventional packaging equipment that requires significant mechanical adjustments for product changes, robotic packaging systems can be rapidly reprogrammed through software to accommodate different products and package designs with minimal downtime. This flexibility enables manufacturers to respond quickly to changing consumer preferences and market demands while maintaining high production efficiency. Additionally, robotic packaging reduces direct human contact with food products, thereby improving hygiene, minimizing contamination risks, and ensuring compliance with international food safety standards. The integration of robotics with AI, machine vision, and Industry 4.0 technologies further enhances productivity, traceability, operational efficiency, and sustainability across the food packaging process.

Emerging Technologies Supporting Food Robotics

The rapid advancement of digital technologies has significantly enhanced the capabilities of robotic systems in the food



Advantages of Food Robotics

industry. Modern food robots are no longer limited to performing repetitive mechanical tasks; instead, they are intelligent systems capable of sensing, analyzing, learning, and making real-time decisions. The integration of technologies such as Artificial Intelligence (AI), Deep Learning, Computer Vision, Internet of Things (IoT), Digital Twins, and Predictive Maintenance has enabled food processing facilities to achieve higher levels of automation, precision, efficiency, and product quality. These smart technologies allow robotic systems to adapt to variations in food size, shape, texture, and packaging requirements while ensuring consistent performance throughout the production process.

Challenges in the Adoption of Food Robotics

Despite the significant advancements and widespread adoption of robotic technologies, several technical, economic, and operational challenges continue to limit their implementation in the food industry. One of the primary barriers is the high initial investment required for purchasing robotic equipment, integrating automation systems, and upgrading existing production infrastructure. While large food manufacturing companies can often absorb these costs, small and medium-sized enterprises (SMEs) may find the investment financially challenging. Furthermore, integrating robotic systems into conventional production lines often requires extensive modifications to equipment, workflow, and factory layouts, leading to increased implementation time and additional costs.

Future Prospects

The future of food robotics is highly

promising. Advancements in AI, sensor technologies, and machine vision will enable robots to perform increasingly sophisticated tasks, including autonomous quality control, adaptive processing, and intelligent production planning. As automation becomes more affordable, robotic systems are expected to become common even in small and medium-sized food processing enterprises. Rather than replacing human workers entirely, robotics is likely to complement the workforce by automating repetitive, physically demanding, and hazardous operations while creating new opportunities in robotics management, maintenance, and data analytics.

Conclusion

Robotics is redefining the future of food processing and packaging by improving efficiency, precision, hygiene, and sustainability. From sorting fresh produce to automated packaging and quality inspection, robotic technologies are helping the food industry meet the growing demand for safe, high-quality food while addressing labour shortages and operational challenges. As technology continues to evolve, the integration of robotics with artificial intelligence and smart manufacturing will play a pivotal role in building resilient, efficient, and sustainable food production systems.

Author's Bio

Dr. G. Pandidurai, PhD, Subject Matter Specialist
ICAR - Krishi Vigyan Kendra (KVK), Tamil Nadu
Veterinary and Animal Sciences University (TANUVAS)
Corresponding author: nanalpandi@gmail.com
Dr. AASIF M., Assistant Professor
School of Agricultural Sciences, Dhanalakshmi
Srinivasan University, Samayapuram
Dr. M.P. Brindhavani, Assistant Professor
School of Agricultural Sciences, Dhanalakshmi
Srinivasan University, Perambalur



TIMKEN

**CONTAMINATION. SPILLAGE. CORROSION.
DAY AFTER DAY.
BUILT TO LAST WHEN HYGIENE AND
DURABILITY MATTER MOST.**



Corrosion Resistant Ball bearing Housed Unit | Corrosion Resistant Poly Round Plain Bearing Housed Units |
Poly Round Plain Bearings | Comprehensive Range of Deep Groove Ball Bearings | Ball Housed Units

SCAN FOR MORE DETAILS

CONTACT US

Timken India Limited
(CIN: L29130KA1996PLC048230)
Tel: +91 (80) 41362000 | Email: salesbangalore@timken.com

www.timken.com/en-in



Stronger. By Design.

From Formulations to Smart Lines: Bridging Ingredient Functionality and Automation in Sweets, Snacks, and Dairy

Pallavi Nitin Ghorpade



Summary

The modern food manufacturing landscape is undergoing a silent revolution. Historically, food processing operated in two distinct domains: the culinary and biochemical formulation created in the R&D laboratory, and the high-speed mechanical engineering executing operations on the factory floor (Rostova & Vance, 2026). For decades, bridging these worlds relied heavily on the tribal knowledge of experienced plant operators who could adjust machine parameters based on touch, visual intuition, or ambient conditions. Today, as consumer demands shift toward clean-label ingredients, reduced sugar, alternative proteins, and zero-defect quality, this traditional approach is no longer sustainable.

The future of processing lies in "Smart Lines" highly automated, sensor-driven production systems engineered to respond dynamically to the physical and chemical behavior of ingredients in real time (van den Berg et al., 2013; Verboven et al., 2020). Achieving seamless integration requires mapping complex ingredient functionality directly into machine control logic across the three most challenging product categories: confectionery (sweets), extruded snacks, and dairy processing.

1. The Core Paradigm: Converting Rheology into Control Logic

At the heart of bridging formulation and automation is rheology—the study of material flow and deformation (Steffe, 1996). Raw agricultural materials and complex formulations exhibit non-Newtonian behaviors including shear-thinning, thixotropy, and viscoelastic elasticity. When recipe formulations are altered (for example, substituting sucrose with polyols or introducing plant proteins into dairy systems), the hydrodynamic and thermal

response during processing changes dramatically.

When an automated line lacks functional awareness, minor variations in batch raw materials lead to cascading line failures: die clogging, uneven sheeting, tailing in confectionery deposition, or syneresis in cultured dairy. Smart lines eliminate these issues by replacing offline laboratory testing with inline process analytical technology (PAT) and closed-loop feedback algorithms (O'Donnell et al., 2014).

KEY ENGINEERING PRINCIPLE: Inline Viscosity Compensation

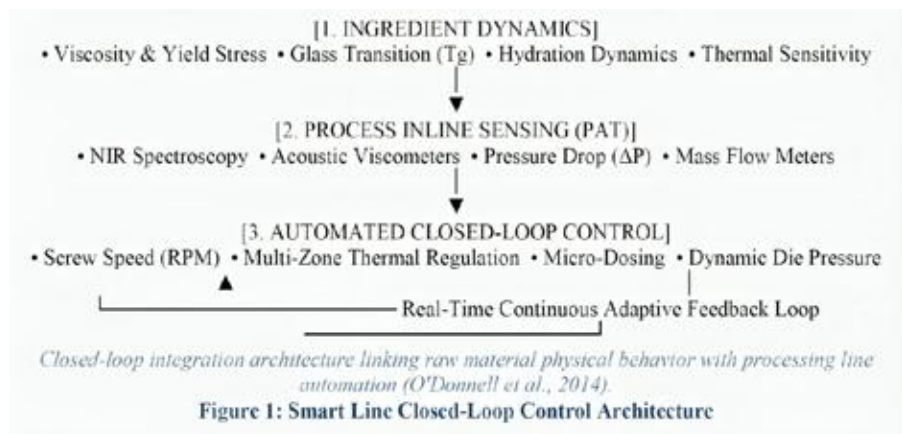
By measuring pressure drops across precise capillary dies inline (ΔP), automated controllers continuously calculate real-time apparent shear rate ($\dot{\gamma}$) and shear stress (τ) (Steffe, 1996). If a natural variation in raw starch flour increases viscosity beyond design limits, the smart system dynamically adjusts barrel heating zones and screw RPM within 200 milliseconds to preserve exact product expansion ratios.

2. Sector Deep-Dives: Sector-Specific Ingredient Dynamics

To understand how functional ingredients interact with smart machinery, we must examine the specific mechanics within the three primary processing pillars: Sweets, Snacks, and Dairy.

A. Confectionery & Sweets: Precision Deposition & Crystallization

This visualization captures the journey from chemical formulation to high-volume manufacturing within the sweets sector. Precision robotic nozzles deposit vibrant gummy candy mixture (3.2% Pectin Concentration) into polished steel molds on a smart conveyor. A translucent blue holographic overlay monitors real-time data, including 'VISCOSITY MONITORING' and 'PECTIN CONCENTRATION: 3.2%', while an integrated screen displays 'GEL STRENGTH



OPTIMIZATION' and a gelatin molecular structure. This system illustrates how precise ingredient data directly calibrates the advanced machine settings for automated, consistent production.

In modern confectionery manufacturing, the movement away from high-sugar formulations to pectin- or gelatin-based gummies and reduced-sugar chocolates presents intense automation challenges. Pectin gelation is strictly dependent on soluble solids (Brix), pH, and temperature cooling profiles (Hartel, 2001). If deposition temperatures drop by as little as 1.5°C, pre-gelation occurs in the hopper, ruining the deposit geometry and producing "stringing" or "tailing".

Automation Bridge: Modern deposition manifolds utilize multi-zone thermal jackets coupled with servo-driven positive displacement piston nozzles. Inline refractometers continuously monitor Brix levels. If a variation in fruit concentrate Brix is detected upstream, the control system automatically regulates steam valve opening on the cooker and alters the servo stroke speed of the depositor, ensuring flawless piece weight and clean tail separation.

B. Snacks & Extrusion: Managing Starch Phase Transitions

A macro perspective on a complex twin-screw extruder head illustrates the interplay between ingredient matrix and smart automation. A matrix of corn and rice flour is dynamically processed, producing puffed snack curls monitored by a blue holographic interface. This interface visualizes 'STARCH GELATINIZATION' and 'AMYLASE ENZYME BREAKDOWN' alongside real-time 'VISCOSITY MONITORING (RHEOLOGY)', 'PECTIN CONCENTRATION', and 'MOISTURE CONTENT: 16.5%'. The precision cutting blade and sensory systems demonstrated here show the automated feedback loop required to maintain optimal product texture and snap.

Direct-expanded snacks depend almost entirely on starch gelatinization and rapid water flash-off at the extrusion die (Moraru & Kokini, 2003). The crucial parameter in snack production is Specific Mechanical Energy (SME), calculated as: $SME = (2\pi \cdot N \cdot \tau) / m$

Where N is screw speed (RPM), τ is applied motor torque (N·m), and m is total mass flow rate (kg/h) (Emin & Schuchmann, 2017). When pulse flours, whole grains, or upcycled fiber ingredients are added to modern snack formulations, they disrupt the continuous starch matrix, leading to dense products, irregular cell structure, and variable bulk density.



Fig No :2 Confectionery Automation



Figure No: 3 Precision Snack Extrusion



Figure No:4 Hygienic Dairy Filling and Monitoring

Automation Bridge: Advanced twin-screw extruders now utilize inline NIR moisture sensors along the feeder matrix and piezoelectric pressure transducers directly behind the die plate. If raw material moisture fluctuates, the PLC adjusts water injection ports along the barrel in real time, while

altering the cutter speed to ensure uniform piece diameter and crisp texture.

C. Dairy Processing: Protecting Complex Protein Matrices

Set in a sterile clean-room environment, this image focuses on a specialized, hygienic

filling machine dispensing viscous yogurt into pots. A multi-nozzle system ensures precision while a prominent holographic interface displays crucial operational data, including 'VISCOSITY (cP)' with a dynamic graph, 'EMULSIFIER STABILITY INDEX', 'PRODUCT TEMP: 4.2°C', and 'CULTURE ACTIVITY: OPTIMAL'. The robotic arm and sensor array demonstrate robust automation managing a delicate, bio-active ingredient matrix to maintain product integrity and safety.

In dairy processing ranging from high-protein yogurts to automated cheese making the physical structure is highly sensitive to shear stress and thermal exposure. Native whey proteins and casein micelles reorganize into complex networks during acidification and heating. Applying uncalibrated mechanical pumping forces can instantly cause syneresis (whey separation) or breakdown of liquid viscosity.

Automation Bridge: Modern smart dairy lines integrate inline ultrasonic density and shear-wave viscometers directly inside processing pipes. During yogurt fermentation and cooling transfers, progressive cavity pumps driven by high-resolution variable frequency drives (VFDs) adjust their speed based on real-time gel strength calculations. This preserves protein gel networks while ensuring high transfer throughput.

3. Comparative Technical Matrix: Raw Ingredients vs Automation Controls

Understanding how raw ingredient variation impacts process parameters is critical for designing automated control loops.

4. Digital Twins and Predictive Manufacturing

The ultimate realization of bridging formulation functionality and line automation is the deployment of Digital Twins (Amirkhanova, 2026; Ugwu, 2026; Verboven et al., 2020). A Digital Twin is a real-time virtual model of the physical production line, powered by machine learning algorithms

Table No. 1 summarizes key sector dynamics

Food Sector	Ingredient Functional Shift	Rheological Impact	Inline Sensing Used	Automated Line Response
Confectionery	Sucrose replacement with Maltitol/ Pectin	Shift in gelation temperature and viscosity curve	Inline refractometer & capillary rheometer	Adjusts hot-water circulation and piston stroke profile
Snacks	Addition of high-protein pulse flour (20%+)	Increased melt viscosity, decreased expansion	Screw torque sensor & die pressure cell	Increases barrel temperature and adjusts micro-water injection
Dairy	Fat reduction / Protein enrichment	Higher shear sensitivity, casein aggregation	Ultrasonic acoustic sensor & inline viscometer	Modulates homogenizer valve pressure & shear pump RPM
Bakery / Sweets	Clean-label emulsifier removal	Lower batter stability, gas retention loss	Density meter & vision tray inspection	Regulates aeration gas injection pressure in continuous mixer

The future of processing lies in “Smart Lines” highly automated, sensor-driven production systems engineered to respond dynamically to the physical and chemical behavior of ingredients in real time (van den Berg et al., 2013; Verboven et al., 2020). Achieving seamless integration requires mapping complex ingredient functionality directly into machine control logic across the three most challenging product categories: confectionery (sweets), extruded snacks, and dairy processing.

trained on ingredient thermodynamic and rheological profiles.

When raw ingredient batches arrive at the plant, rapid NIR scan data (e.g., protein %, moisture %, particle size distribution) is instantly uploaded to the Digital Twin. Before the raw material even enters the mixer or extruder, the Digital Twin runs predictive physics simulations and calculates the optimal operational envelope pre-setting barrel temperatures, mixing shear speeds, knife frequencies, and line velocity.

Strategic Industry Key Takeaways

- Silos Must Dissolve: R&D food scientists and plant automation engineers must collaborate during initial formulation development rather than during plant startup.
- PAT Is Mandatory: Moving from offline lab testing to inline, non-destructive sensing (NIR, acoustic, pressure-drop) is essential for handling raw material natural variability.
- Agility Means Profitability: Smart lines capable of handling formulation variations automatically experience up to 40% less downtime, 25% lower scrap rates, and significantly faster product changeovers.
- Future-Proofing via AI: As clean-label and novel non-animal proteins evolve, AI-driven digital twins will become the standard for predictive process control.

Author's Bio

Pallavi Nitin Ghorpade , M.sc Food technologist, MGM University, N-6 Cidco Chh.Sambhajanagar, 431003, Maharashtra-India pallavinghorpade419@gmail.com

References

Amirkhanova, G. (2026). Closed-loop digital twin for energy-efficient scheduling in food manufacturing systems. *Information*, 17(2), Article 195.
Bureau, G., & Multon, J. L. (1996). *Food packaging technology*. Wiley-VCH.
Emin, M. A., & Schuchmann, H. P. (2017). Analysis of the disperse structure formation in high moisture extrusion cooking of plant proteins. *Journal of Food Engineering*, 208, 9–17. <https://doi.org/10.1016/j.jfoodeng.2017.03.023>

Hartel, R. W. (2001). *Crystallization in foods*. Aspen Publishers. <https://doi.org/10.1007/978-1-4615-1283-7>
Moraru, C. I., & Kokini, J. L. (2003). Nucleation and expansion during extrusion cooking of starchy products. *Comprehensive Reviews in Food Science and Food Safety*, 2(4), 147–165. <https://doi.org/10.1111/j.1541-4337.2003.tb00020.x>
O'Donnell, C. P., Fagan, C. C., & Cullen, P. J. (Eds.). (2014). *Process analytical technology for the food industry*. Springer. <https://doi.org/10.1007/978-1-4939-0311-5>
Rostova, E., & Vance, M. (2026). From formulations to smart lines: Bridging ingredient functionality and automation in sweets, snacks, and dairy. *Food Engineering Today*, 48(7), 18–25.
Steffe, J. F. (1996). *Rheological methods in food process*

engineering (2nd ed.). Freeman Press.
Ugwu, C. N. (2026). Digital twins for food processing and shelf-life: Linking mechanistic models, sensors, and AI to predict quality, safety, and waste through near-real-time decision support. *Frontiers in Food Science and Technology*, 6, Article 1813819. <https://doi.org/10.3389/frfst.2026.1813819>
van den Berg, F., Lyndgaard, C. B., Sørensen, K. M., & Engelsen, S. B. (2013). Process analytical technology in the food industry. *Trends in Food Science & Technology*, 31(1), 27–35. <https://doi.org/10.1016/j.tifs.2012.04.007>
Verboven, P., Defraeye, T., Datta, A. K., & Nicolai, B. (2020). Digital twins of food process operations: Concept, state of the art, and future prospects. *Current Opinion in Food Science*, 35, 121–128. <https://doi.org/10.1016/j.cofs.2020.04.008>

SEW MOBILE MATERIAL-HANDLING

Inspired by Nature, Engineered for Efficiency

SEW
EURODRIVE

Driving the world

At SEW-EURODRIVE, we're inspired by the remarkable engineering in nature and strive to bring the same smart design and efficiency to our products.

Just as expert navigation is in leafcutter ants' DNA, our Mobile Material-Handling solutions synchronise your material flow seamlessly across dynamic factory systems, following optimised paths.

Our Industry 4.0 solutions – Automated Guided Vehicles (AGVs) and Electrified Monorail System (EMS) – are fully customisable and built to German standards. And with expert support across India, we ensure smooth material-handling.

Efficiency: It's in our D.N.A.



Leafcutter ants are nature's expert transporters. These tiny powerhouses carry leaf fragments many times their weight. They navigate obstacles across tough terrains without set routes yet ensure smooth cargo movement.



SEW-EURODRIVE MOBILE MATERIAL-HANDLING SOLUTIONS:

Automated Guided Vehicles (AGVs) | Rail Guided Vehicles (RGVs)
Electrified Monorail System (EMS) | Power Management

+91 96866 24322 | marketing@seweurodriveindia.com
www.seweurodriveindia.com

INSPECT + PROTECT: Understanding Critical Control Points for Better Contaminant Detection



Kati Hope, Global Key Account Manager, Mettler-Toledo Product Inspection



In food production, contamination risks exist at every stage, from goods-in to final packaging. Identifying where to detect those risks is vital to not only protect consumers, but to prevent further contamination downstream, avoid damage to processing equipment, reduce unnecessary waste, and preserve profit margins. The earlier a contaminant is identified, the less value has been added to the product, minimising both product loss and rework costs. Metal detection and x-ray inspection systems, installed in the correct place on a production line, can also stop physical contaminants from damaging blades, pumps or other sensitive machinery, which could otherwise lead to downtime and expensive repairs.

Determining where inspection should take place is rooted in risk assessment and the correct identification of Critical Control Points (CCPs). Yet with varying product formats, packaging types and processing methods, there is no one-size-fits-all CCP. Each production line needs a considered approach based on where physical contamination is most likely to occur, and where detection will be most effective. This analysis drives the technology choice, as metal detectors and x-ray inspection systems each perform differently depending on the product characteristics and line conditions.

Identifying Risk Across the Production Line

The first step in identifying CCPs is conducting a detailed hazard analysis as part of the overall Hazard Analysis Critical Control Point (HACCP) plan. This involves mapping the production flow in full and evaluating where physical hazards such as glass, metal, stone, bone or dense plastic could be introduced or missed.

The analysis also considers how contaminants might change. For instance, stages such as chopping, grinding or cooking can reduce their size or density, making them more difficult to detect. Packaging and product format matter too. Some inspection technologies are better suited to homogeneous, unpackaged materials, while others perform well on sealed formats.

Choosing CCPs Wisely

At the start of production, during goods-in, the risk of contamination is often at its highest. Ingredients such as flour, grains or dried fruit may contain foreign bodies introduced during harvesting or transport. Inspection at this stage, using gravity-fall metal detection systems or bulk-flow x-ray systems, allows these contaminants to be removed before they damage downstream production equipment or reach finished goods stage.

Early-stage detection also helps reduce waste by rejecting contaminated product before any further value is added.

For bulk or pumped products like frozen berries, purées or sauces, detection sensitivity tends to be higher. These products are typically homogeneous or shallow in depth, which improves the chances of identifying small or low-density contaminants. Pipeline or conveyorised systems are often used for this purpose.

The processing stage can also introduce new hazards, such as fragments from worn blades or broken machinery. Existing contaminants not captured earlier in production may also become smaller and more difficult to detect. For example, cooked poultry bones are less dense than raw bones, which makes them harder to identify. Introducing a contamination detection solution before and after processing helps to manage both incoming foreign bodies and those caused by equipment wear.

In some cases, it is most efficient to inspect products just before packaging. At this point, the product is complete but not yet enclosed, so detection is less affected by packaging materials. It also avoids the cost of rejecting fully packaged goods. For example, inspecting cooked chicken fillets after processing but before tray sealing enables detection of bone fragments or metal shavings while still allowing contaminated units to be removed without wasting the packaging or disrupting downstream packing operations.

The most common location for inspection remains at the end of the line, after packaging and sealing. This provides a final check before products leave the factory and is particularly useful for identifying contaminants introduced during the sealing process, such as fragments from broken or damaged jars or closures. Here, x-ray inspection systems can also simultaneously verify fill levels, product placement and seal quality whilst completing contamination detection checks.

Although end-of-line inspection covers a wide range of risks, earlier stages of the line often provide better sensitivity, especially for unpackaged or uniform products.

Metal Detection, X-ray Inspection or Both?

Choosing the right detection method is critical. Both metal detection and x-ray inspection are widely used, but each has its own strengths and operational considerations that

influence where they are best installed on the production line. Metal detection is effective at identifying ferrous, non-ferrous, and stainless steel metal contaminants. It performs well with unpackaged products or those in non-metallic packaging but may be affected by product characteristics such as moisture, salt content or metallised film. Modern metal detection technologies can significantly reduce the impact of these product effects through advanced signal processing, multi-simultaneous frequency operation combined with intelligent algorithms, and improved noise and vibration suppression. These next generation systems enable manufacturers to achieve higher detection performance across a broader range of applications.

X-ray inspection can detect a wide range of contaminants, including metal, glass, bone, stone, and dense plastics and is suitable for a range of packaging types. It can also carry out additional quality checks, such as inspecting for missing components or trapped product in seals. Like any inspection technology, x-ray has operational considerations. Detection capability is influenced by contaminant density relative to the product, meaning very low-density materials may be more challenging to detect. Aluminium contaminants can also be difficult to detect where density contrast with the surrounding product is limited. Product thickness, orientation and overlap may further affect inspection sensitivity.

Some production lines benefit from using both technologies at different CCPs. The decision depends on the nature of the product, the risks involved, packaging type and the sensitivity required.

A Balanced, Risk-Based Approach

There is no single correct location for these contamination detection systems. The best outcomes are achieved by combining HACCP principles, practical knowledge of the production line and an understanding of technology capabilities. While end-of-line inspection is common, early-stage detection often provides better sensitivity and can reduce overall waste. In more complex operations, multiple CCPs may be needed.

What matters most is that the chosen CCPs reflect a realistic, risk-based view of the production environment. As products, processes and standards evolve, so too should the contamination detection strategy. It should be regularly reviewed and adapted in response to operational changes, new technologies or updated safety standards, remaining as dynamic as the environment it protects.

For more information, click here or visit www.mt.com/pi-contam-eguide-pr

Food Processing Machinery Market Set for Strong Growth as Automation Reshapes Production



The global food processing machinery market is witnessing steady expansion as food manufacturers invest in technologies that improve productivity, consistency, safety and operational efficiency. The market is projected to grow from \$64.81 billion in 2025 to \$68.27 billion in 2026, registering a compound annual growth rate (CAGR) of 5.3%. It is further expected to reach \$87.14 billion by 2030, representing a CAGR of 6.3% during the forecast period.

The growth of the market is being driven by several structural changes across the food industry, including the expansion of industrial food manufacturing, rising demand for packaged and convenience foods, development of cold chain infrastructure and increasing mechanisation of food handling and processing operations. Food manufacturers are increasingly replacing labour-intensive processes with automated and high-performance machinery to improve throughput, maintain consistent product quality and meet growing production requirements.

Rising consumption of processed foods is another major factor supporting machinery demand. Processed foods—including cooked, canned, frozen, dried and packaged products—require specialised equipment for preparation, cooking, mixing, cutting, freezing, drying, preservation and packaging. Data reported by the American Frozen Food Institute (AFFI) in July 2023 highlighted growth across several frozen food categories. Frozen fruit recorded an 8.8% increase in unit sales, while processed chicken rose 9.6%, breakfast sausage 7.4% and beef 3.1%. Frozen meal categories also recorded growth, including pizza at 1.3%, side dishes at 3.2%, fries at 0.6% and tater tots at 8.2%. Such demand is encouraging manufacturers to expand capacity and invest in modern processing equipment.

Technology is expected to become an increasingly important differentiator in the machinery market. Food processors are

investing in automation, smart sensors, digital monitoring, artificial intelligence (AI) and advanced process-control systems to optimise production lines. These technologies can help manufacturers monitor critical production parameters in real time, identify deviations, reduce downtime and improve consistency. Automation is also being applied across processing, material handling, filling, packaging and quality-control operations, enabling manufacturers to achieve higher throughput while reducing dependence on manual intervention.

The forecast period is also expected to see greater emphasis on smart factories and sustainable processing. Investments in AI-driven process optimisation, modular processing lines and high-throughput machinery are likely to increase as manufacturers seek flexible systems that can accommodate changing consumer demand and product formats. At the same time, equipment designed to reduce energy and water consumption, minimise product losses and improve resource efficiency is gaining importance as food companies focus on sustainability and waste reduction.

Food safety and regulatory compliance will remain another critical area shaping machinery development. Modern processing equipment is increasingly being designed to support hygienic production, automated cleaning, traceability and tighter quality control. Major companies in the market are therefore focusing on innovative food processing automation solutions that integrate processing, packaging and quality-control functions. As food manufacturers seek greater efficiency alongside safer, more sustainable production, the integration of automation and intelligent technologies is expected to remain a key driver of the food processing machinery market through 2030.

researchandmarkets

Metal Cans on the Rise: How Sustainability is Reshaping the Future of Packaging



The global packaging industry is entering a period of significant transformation, with metal cans emerging as one of the most resilient and rapidly expanding formats. Growing demand for recyclable, durable and consumer-friendly packaging is positioning metal cans as a key segment within the broader chemicals and materials industry. As brands, regulators and consumers increasingly prioritize sustainability, metal cans are gaining importance not only as packaging solutions but also as strategic components of the circular economy.

According to a comprehensive market research report published by Polaris Market Research, the global metal cans market was valued at USD 76.75 billion in 2025. The market is projected to increase from USD 79.98 billion in 2026 to USD 113.76 billion by 2034, registering a CAGR of 6.5% during the forecast period from 2026 to 2034. The growth reflects the increasing role of metal packaging in sustainability initiatives, beverage innovation and evolving consumer consumption patterns.

Why Metal Cans? The Packaging Format Winning on Every Front

Metal cans are gaining momentum at a time

when consumers, regulators and brand owners are seeking packaging formats that combine sustainability with functionality. Aluminum and steel cans offer durability, recyclability and supply chain efficiency, making them well suited to the industry's transition toward a circular packaging economy. Unlike many plastic formats, aluminum and steel can be recycled repeatedly without losing the fundamental quality of the material.

The rising consumption of ready-to-drink (RTD) beverages is another major factor supporting market expansion. Energy drinks, craft beers, carbonated soft drinks and functional wellness beverages are increasingly being offered in metal cans. Their portable, leak-proof and shelf-stable characteristics make cans particularly suitable for today's on-the-go consumption habits across both developed and emerging markets.

Segmental Deep-Dive: Where the Growth Is Coming From

By Material: Aluminum Dominates

Aluminum cans accounted for the largest share of the market in 2025, representing 48% of the total market. Their lightweight construction, corrosion resistance and strong recyclability profile have contributed to their

widespread adoption, particularly in beverage packaging. Aluminum's position in beverage applications, including soft drinks and energy drinks, is expected to remain strong and continue expanding through 2034. Steel cans, meanwhile, maintain a significant position in food preservation applications, particularly where structural strength and resistance to heat are critical requirements.

By Product Type: 2-Piece Cans Lead the Pack

By product type, 2-piece cans held a 42% market share in 2025. Their seamless construction, efficient manufacturing process and design flexibility have made them a preferred format for high-volume beverage applications. Carbonated soft drinks and energy beverages continue to represent important applications for 2-piece cans. At the same time, Drawn & Redrawn (DRD) cans are gaining momentum in premium food packaging applications, including processed foods and ready-to-eat meals, where manufacturers are increasingly looking for packaging that combines functionality with an attractive appearance.

By Application: Beverage Cans Reign Supreme

Beverage cans remained the leading application segment in 2025, accounting for 55% of the total market share. Aluminum cans provide effective protection against UV light, help preserve carbonation and contribute to extended shelf life. These characteristics continue to give metal cans an advantage in beverage applications compared with flexible and plastic packaging formats. Food cans represent another major application area. They are widely used for vegetables, fruits, soups and meat products, where protection against contamination and preservation of product quality are essential.

Regional Spotlight: Four Markets, Four Narratives

North America represented the largest regional market in 2025, accounting for 37% of the global share. The region benefits from a well-established packaged beverage culture as well as one of the world's most developed metal recycling infrastructures. The U.S. market continues to gain from advances in lightweight can technology and increasing demand for craft beverages and functional drinks.

Europe accounted for 29% of the market. Germany, France and the United Kingdom are among the leading markets in the region, supported by growing emphasis on circular economy practices. Stringent EU packaging regulations and Extended Producer Responsibility (EPR) frameworks

are encouraging brands to accelerate their transition toward recyclable packaging formats, including metal.

Asia Pacific represents the fastest-growing regional market, with a growth rate of 6.1%. Rapid urbanization, an expanding middle class and the growing availability of packaged food and beverages across China and India are creating significant opportunities for metal can manufacturers.

According to UN-Habitat, Asia's urban population already exceeds 2.2 billion and is projected to increase by an additional 1.2 billion by 2050. This continued expansion of urban populations is expected to support long-term consumption growth and create substantial opportunities for packaged food and beverage formats.

Latin America and the Middle East & Africa are also recording steady expansion, with the two regions growing at a combined CAGR of 4.2%. Industrialization and modernization of the retail sector in markets such as Brazil, Mexico and the UAE are contributing to increasing demand for packaged products and, consequently, metal packaging.

Market Drivers: The Tailwinds Are Strong

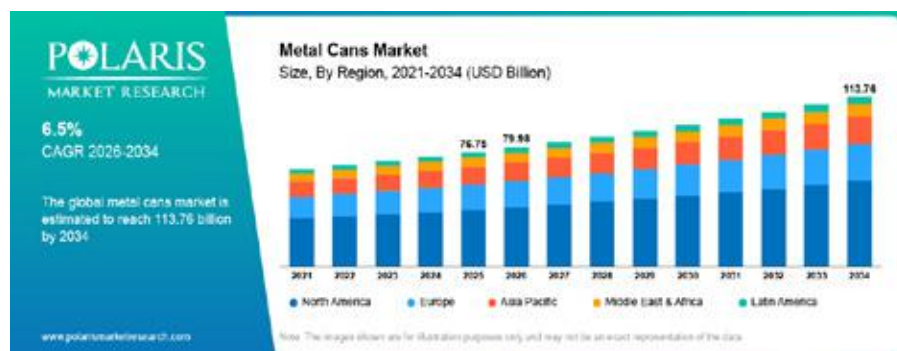
1. The Sustainability Imperative

Sustainability regulations and ESG investment priorities are increasingly influencing packaging procurement decisions throughout the supply chain. Metal cans are benefiting from this shift because both aluminum and steel are recyclable materials that can support circular packaging systems. A notable development came in March 2026, when Henkel launched a tinplate can packaging solution using CO₂-reduced bluemint steel. The solution achieved up to 62% lower emissions compared with conventional tin cans. The development represents an important industry milestone and highlights the growing focus on reducing the carbon footprint associated with metal packaging production.

2. The RTD Beverage Boom

The continued global expansion of energy drinks, hard seltzers, cold-brew coffees and functional wellness beverages is directly increasing demand for metal cans. Beverage manufacturers and brand owners are increasingly shifting away from single-use plastic bottles toward aluminum cans as they seek packaging formats that support both sustainability objectives and changing consumer preferences.

Metal cans also provide substantial branding opportunities. Digital printing enables brands to create visually distinctive designs and more



flexible packaging campaigns while retaining the functional and environmental advantages associated with aluminum packaging.

3. Innovation in Smart & Lightweight Packaging

Technological developments are creating new opportunities across the metal cans industry. Digital printing, QR code integration, BPA-free coatings and lightweight can engineering are helping manufacturers improve functionality while reducing material usage and enhancing the consumer experience. Brands are also adopting interactive labeling and track-and-trace technologies to strengthen consumer engagement and improve supply chain transparency. These developments are enabling packaging to become a more active communication and information platform without compromising the structural integrity of the can.

Challenges: Navigating the Headwinds

Despite strong growth prospects, the metal cans industry continues to face challenges. One of the most significant restraints is volatility in aluminum prices. Because aluminum is a critical raw material, fluctuations in commodity prices can create considerable margin pressure throughout the manufacturing value chain.

Smaller regional producers can be particularly vulnerable to these fluctuations. To manage the risk, companies are increasingly considering strategies such as commodity hedging, long-term supply agreements and greater integration of recycled content into their manufacturing processes. These approaches can help manufacturers reduce exposure to raw material price volatility while supporting broader sustainability objectives.

Competitive Landscape: The Power Players

The global metal cans market remains highly competitive, with participation from major international manufacturers as well as regional specialists. Companies profiled in the Polaris Market Research report include Ball Corporation, Crown Holdings, Ardagh Group S.A., Silgan Holdings Inc., Can-Pack S.A., CCL

Industries Inc., Oricon Enterprises Limited and Hindustan Tin Works Ltd., among others.

Across the industry, strategic priorities are increasingly focused on lightweighting, circular packaging integration, advanced coating technologies and geographic expansion. High-growth markets in Asia Pacific and the Middle East are particularly important areas of interest as manufacturers seek to capitalize on rising packaged food and beverage consumption.

An important industry development took place in December 2024, when Ball Corporation partnered with Dabur to launch Réal Bites juice in aluminum cans. The initiative was specifically aimed at reducing plastic usage and supporting the adoption of sustainable packaging in India's rapidly expanding juice market.

Outlook: Metal Cans Are Built for the Next Decade

The metal cans industry is entering a period of sustained opportunity as three major forces converge: stronger sustainability regulations, rising RTD beverage consumption and continued packaging innovation. Together, these trends are expected to support a powerful multi-year growth cycle for the sector.

Companies that accelerate their adoption of circular economy practices, smart packaging technologies and advanced lightweight materials are likely to be better positioned to capitalize on the expanding market, which is projected to reach USD 113.76 billion by 2034.

For investors, procurement leaders, packaging manufacturers, technology providers and brand strategists, understanding the changing dynamics of the metal cans market will be increasingly important. Segment-level demand shifts, regional growth opportunities, raw material risks and innovations in sustainable packaging will all play a role in determining how companies capture opportunities in this USD 113+ billion market.

polarismarketresearch



29 | **30** | **01** | **2026** BOMBAY EXHIBITION
SEPT | SEPT | OCT CENTRE, MUMBAI

VISIT

SOUTH ASIA'S LARGEST EXPO FOR FOOD & BEVERAGE INDUSTRY

Discover the complete food and beverage value chain from ingredients and finished products processing to packaging technology all under one roof.



1100+

Global &
Indian Exhibitors

55,000+

Industry Professionals

52,000 sqm

of Business &
Innovation

31

Countries
Represented

150+

Expert Speakers &
Master Chefs

**REGISTER NOW
FOR FREE**

**SAVE ₹1000
ON ONSITE FEES**

F&B RETAIL & HORECA

SCAN TO PRE-REGISTER



F&B MANUFACTURERS

SCAN TO PRE-REGISTER



Contact for more details:

Chandrika Thapa

✉ +91 88281 44168

📧 c.thapa@koelnmesse-india.com



Smart Dairy Packaging: Next-Generation Solutions for Longer Shelf Life and Food Safety

Biswanath Dey, Manaswini Ghosh



Packaging Becomes a Critical Part of the Dairy Value Chain

As dairy producers respond to rising demand for convenience, extended distribution networks and longer product shelf life, packaging is evolving from a basic containment solution into a critical food-protection technology. Milk, flavoured milk, yoghurt, cream, cheese and other dairy products are highly sensitive to temperature, oxygen, light and microbial contamination. As a result, modern dairy packaging is increasingly designed to protect product quality throughout processing, transportation, storage and retail. The shift towards smart dairy packaging combines advanced materials, aseptic filling, high-barrier structures, intelligent labels and tamper-evident formats. These technologies help manufacturers reduce spoilage, maintain nutritional and sensory quality, strengthen food safety and provide consumers with greater confidence in product integrity.

Aseptic Packaging Extends the Life of Dairy Products

Aseptic packaging remains one of the most important technologies for extending the shelf life of dairy products. In aseptic processing, the product and packaging are commercially sterilised separately before being brought together in a controlled environment. This significantly reduces the risk of microbial contamination and enables products such as UHT milk and flavoured milk

to achieve extended shelf life without relying on conventional refrigeration throughout the distribution chain.

Modern aseptic cartons and bottles are engineered as multi-layer structures, combining materials that provide mechanical strength, protection against oxygen and light, and effective sealing. For dairy manufacturers, this creates opportunities to distribute products over longer distances while reducing dependence on continuous refrigeration before opening.

High-Barrier Materials Strengthen Product Protection

The performance of dairy packaging increasingly depends on the barrier properties of its materials. Oxygen and moisture can accelerate oxidation, flavour deterioration and other quality changes, while light exposure can negatively affect certain nutrients and sensory characteristics of milk. High-barrier films, laminates and multilayer packaging structures are therefore being adopted to create stronger protection against external environmental factors. Barrier layers can be incorporated into cartons, flexible pouches, cups, lidding films and bottles depending on the product and required shelf life.

For milk and other light-sensitive dairy products, light-blocking packaging is particularly important. Opaque cartons and specially engineered multilayer structures

can limit exposure to ultraviolet and visible light, helping preserve product quality during storage and retail display.

Oxygen and Light Protection for Sensitive Dairy Products

Controlling oxygen transmission is another important consideration, particularly for products where oxidation can affect flavour, colour, aroma or nutritional quality. Packaging manufacturers are developing improved barrier structures that minimise oxygen ingress while maintaining package integrity and processability. For yoghurt, flavoured dairy beverages and other products, packaging must also provide effective protection against external contamination while maintaining the desired texture and sensory properties. The combination of appropriate barrier materials, controlled headspace and reliable sealing can contribute significantly to maintaining product quality over its intended shelf life.

Intelligent Packaging Brings Visibility to Product Conditions

The next stage of dairy packaging is moving beyond passive protection towards intelligent packaging. Intelligent indicators and labels can provide information about conditions experienced by the product during storage and distribution. Time-temperature indicators (TTIs), for example, can provide a visual indication of cumulative temperature exposure. Such systems can be particularly valuable for refrigerated dairy products because temperature abuse can accelerate quality deterioration even when the product remains within its printed expiry period. Other smart-label technologies can incorporate sensors or data-enabled features to support traceability, authentication and supply-chain monitoring. For manufacturers and distributors, these solutions can provide additional visibility into product handling and help identify potential weaknesses in the cold chain.

Tamper-Evident Formats Strengthen Consumer Confidence

Food safety begins with preventing contamination, and tamper-evident packaging is becoming an increasingly important component of dairy product protection. Sealed caps, breakable rings, peelable membranes, shrink bands and other tamper-evident features allow consumers to identify whether a package may have been opened or compromised. For products such as milk, yoghurt, cream and flavoured beverages, these systems provide an additional layer of protection between filling and consumption. At the same time, clearly visible tamper evidence can strengthen consumer confidence and reinforce the manufacturer's commitment to product safety.

Smart Labels Connect Packaging with the Digital Supply Chain

Smart labels are also creating new possibilities for interaction between dairy products, manufacturers, retailers and consumers. QR codes, digital identifiers and connected packaging can provide access to information such as product origin, batch details, manufacturing information, storage guidance and recycling instructions. For dairy manufacturers, digitally enabled packaging can also support traceability and product authentication. In the event of a quality issue or recall, improved batch-level identification can help companies respond more efficiently. Connected packaging may therefore become an important bridge between physical product protection and digital supply-chain management.

Packaging Solutions for Different Dairy Products

Different dairy products require different packaging strategies. UHT and extended-shelf-life milk benefit strongly from aseptic processing combined with high-barrier, light-protective packaging. Flavoured milk and dairy beverages require protection against oxygen, light and contamination while also supporting convenient formats such as resealable bottles and cartons.

For yoghurt, packaging must provide reliable sealing and protection against contamination while accommodating products with different viscosities and formats. High-barrier cups, multilayer lidding films and improved sealing technologies can help maintain product quality. Other dairy products, including cream, desserts and cultured products, similarly require packaging structures selected according to their oxygen sensitivity, moisture requirements, processing conditions and distribution environment.

Automation Improves Packaging Safety and Consistency

Advanced packaging technologies are increasingly being integrated with automation and digital quality-control systems. Automated filling, sealing and inspection equipment can improve consistency while reducing the possibility of human error. Vision systems can inspect seals, closures, labels and package integrity at high production speeds, while sensors can monitor critical packaging parameters. For large dairy processing plants, the integration of packaging equipment with plant-level data systems can also support predictive maintenance, production monitoring and quality assurance. This enables manufacturers to move towards more connected packaging lines in which processing, filling, inspection and traceability work as an integrated system.

Dairy Packaging Market: Growth Driven by Rising Consumption and Sustainability

The global dairy packaging market is witnessing steady expansion, supported by growing consumption of milk, yoghurt, cheese, flavoured milk and other dairy-based products. Valued at USD 25.58 billion in 2025, the market is projected to reach USD 26.71 billion in 2026 and USD 39.15 billion by 2034, registering a CAGR of 4.89% during the forecast period. North America accounted for the largest share, at 33.55% in 2025. Rising consumer demand for nutritious foods and beverages rich in protein and natural calcium is encouraging dairy manufacturers to invest in packaging that protects products from contamination, physical damage, light and oxygen while maintaining freshness and quality. At the same time, the growing popularity of flexible packaging is creating new opportunities because of its versatility, lightweight nature and potential for recyclability. Leading packaging manufacturers such as Amcor and Sonoco continue to play a significant role in meeting the evolving requirements of dairy producers.

Sustainability is emerging as another major factor shaping the future of dairy packaging. Growing concerns over plastic waste, combined with stricter environmental regulations, are encouraging brands to reduce their dependence on conventional packaging and explore recyclable plastics, paperboard, bioplastics, biodegradable materials and plant-based films. Packaging solutions are increasingly being designed to reduce material consumption and carbon footprint without compromising product protection or shelf life. For dairy processors, the challenge is to balance sustainability with the stringent barrier, hygiene and sealing requirements essential for perishable products. Innovations in lightweight formats, recyclable structures and more resource-efficient packaging are therefore gaining momentum. As consumers increasingly favour environmentally responsible brands, the shift toward sustainable dairy packaging is expected to remain a key growth driver for the global market through the coming years.

fortunebusinessinsights

Sustainability Meets Shelf-Life Performance

While longer shelf life can help reduce food waste, dairy manufacturers are simultaneously under pressure to reduce packaging material use and improve recyclability. This creates a complex challenge: packaging must provide sufficient barrier performance and structural integrity without becoming unnecessarily material-intensive. Lightweighting, downgauging, recyclable structures, paper-based solutions and improved mono-material packaging are among the approaches being explored across the industry. The challenge is to balance shelf-life requirements, food safety, packaging performance, recyclability and overall environmental impact rather than focusing on any single parameter.

The Future of Smart Dairy Packaging

The future of dairy packaging is likely to be increasingly connected, protective and data-driven. Advances in barrier materials, aseptic technology, intelligent indicators, tamper-evident systems, digital labels and automated inspection are enabling packaging to play a more active role in preserving product quality and ensuring food safety.

For dairy processors, the objective is no longer simply to select a container for the finished product. Packaging has become part of the overall preservation strategy—working alongside processing technology,



refrigeration, logistics and quality management. As dairy supply chains become longer and consumers demand greater convenience and transparency, smart packaging will increasingly become a strategic technology for extending shelf life, reducing food waste and delivering safer, higher-quality dairy products to the market.

Authors are Independent, non-commercial contributor with no remuneration received and no declared conflict of interest



Powering Safer, Smarter and More Sustainable Food Production with Oil-Free Air Technology

“ In an interaction with Food & Beverages Processing Magazine, Mr. Sunil Natekar, Business Line Manager – Oil-Free Air, Compressor Technique, Atlas Copco (India) Private Limited, shares insights into how oil-free compressed air, smart technologies and nitrogen generation solutions are helping food and beverage manufacturers improve food safety, efficiency and sustainability. He also discusses energy-efficient compressors, digital monitoring and connected systems, and how these technologies are shaping the future of food production.

Mr. Sunil Natekar, Business Line Manager – Oil-Free Air, Compressor Technique, Atlas Copco (India) Private Limited

Atlas Copco has been at the forefront of industrial innovation for over 150 years. Could you briefly introduce the Compressor Technique business and its role in supporting the food and beverage industry?

Atlas Copco's Compressor Technique business focuses on offering reliable compressed air and industrial gas solutions that help manufacturers maintain safe, efficient and productive operations. In the food and beverage (F&B) sector, compressed air is often considered the fourth utility because it is used across critical processes such as ingredient conveying, fermentation, packaging, bottling, filling, cleaning and nitrogen generation.

Our role goes beyond supplying compressors. We work closely with customers to understand their production requirements and provide complete air and gas solutions that support product quality, operational reliability and energy efficiency. Food manufacturers work in an environment where contamination risks, downtime and rising energy costs can have a significant impact on business performance. This is where our expertise becomes valuable.

Atlas Copco has been a pioneer in oil-free air technology and was the first compressor manufacturer to achieve ISO 8573-1 Class 0 certification for oil-free air. Our portfolio includes compressors, dryers, filters, nitrogen generators, monitoring systems and service solutions designed specifically for industries where air quality is critical. By combining innovation, application knowledge, and a strong service network, we help F&B companies maintain high production standards while improving efficiency and reducing operating costs.

Compressed air plays a critical role in food processing and packaging operations. How are Atlas Copco's oil-free compressor technologies helping manufacturers enhance product quality, safety, and operational efficiency?

In the food and beverage industry, compressed air regularly comes into direct or indirect contact with products. Even minor amounts of oil can degrade product quality, pose contamination hazards, and result in significant production losses. That is why many manufacturers are switching to oil-free compressed air technologies.

Atlas Copco's oil-free compressors are designed to eliminate contamination risks at the source. As the first manufacturer to achieve ISO 8573-1 Class 0 certification, we provide compressed air with no detectable oil in the output stream. This gives food manufacturers confidence that their products remain protected throughout processing and packaging operations. Beyond product safety, oil-free technology also supports operational efficiency. Since there is no oil in the compression process, manufacturers can avoid costs associated with filter replacements, condensate treatment, and pressure drops caused by filtration systems. Our Variable Speed Drive (VSD) technology further improves efficiency by matching air output to actual demand, helping reduce energy consumption while maintaining stable production.

Cleaner air, improved process dependability, less maintenance needs, and more assurance regarding product quality and brand reputation are the outcomes for food manufacturers.

Food safety and regulatory compliance are top priorities for food manufacturers.

How do your air and gas solutions help companies meet stringent hygiene and quality standards?

Food manufacturers undoubtedly operate under strict quality and safety requirements. Compliance is more than just meeting regulations, it is also about protecting consumers and maintaining brand trust. Compressed air quality plays a critical role in achieving these objectives.

Atlas Copco helps customers meet stringent standards through a complete portfolio of oil-free compressors, air treatment equipment, and gas generation systems. Our oil-free compressors are certified according to ISO 8573-1 Class 0, the highest air purity standard, ensuring that there is no risk of oil contamination from the compression process.

As mentioned earlier, Atlas Copco became the first compressor manufacturer to receive ISO 22000 certification for its oil-free production facility. This reflects our commitment to food safety management and provides customers with greater transparency and confidence in the equipment they use.

We also support customers with dryers, filtration systems, air quality expertise and application guidance to help them maintain compliance throughout their production process. Whether compressed air is used for conveying ingredients, packaging products, or generating nitrogen for food preservation, our solutions are designed to support safe, hygienic, and reliable operations.

Sustainability and energy efficiency are becoming key considerations across manufacturing sectors. How is Atlas Copco helping food and beverage companies reduce energy consumption and improve their environmental performance?

Atlas Copco focuses on helping customers reduce energy use through advanced compressor technologies, Variable Speed Drive systems, energy recovery solutions, and intelligent system design. Our VSD compressors automatically adjust output based on real-time air demand, avoiding unnecessary energy consumption associated with fixed-speed systems. We also offer energy recovery technologies that allow manufacturers to capture and reuse heat generated during the compression process. This recovered energy can be used in other production activities, reducing overall energy requirements.

From sustainability perspective, Atlas Copco helps food and beverage companies reduce their overall environmental footprint while supporting ESG and lower carbon emissions.

a. Lower Carbon Emissions

Energy consumption is one of the largest contributors to a food manufacturer's carbon footprint. Atlas Copco's high-efficiency compressors and VSD+ technology reduce electricity usage by matching compressed air production to actual demand.

b. Circular Energy Use Through Heat Recovery

Rather than allowing compressor-generated heat to be wasted, Atlas Copco's energy recovery systems capture and reuse it for process heating, hot water generation, and facility heating. This creates a more circular energy model and reduces dependence on fossil-fuel-based heating systems.

c. Reduced Food Waste and Resource Loss

Class 0 oil-free compressed air eliminates the risk of oil contamination in food products. By ensuring product integrity and compliance with food safety standards, manufacturers can reduce product rejection, waste, and the associated environmental burden of discarded food.

d. Improved Operational Sustainability

Digital monitoring platforms such as SMARTLINK provide visibility into energy consumption, system efficiency, and air leaks. This enables continuous optimization, helping plants consume fewer resources while maximizing equipment life and reducing unnecessary maintenance-related waste.

Sustainable production of ice-cream

Thanks to our colleagues in Finland who shared this fantastic customer story!

In the movie you can see how a ZR 160 VSD+ FF combined with an Optimizer 4.0 help Froneri manufacture over 100.000 ice creams on a daily basis. The key reasons for choosing Atlas Copco were energy efficiency,

reliability and prompt after sales support. Our equipment has helped them with their goal of reducing their energy consumption. Because ice cream doesn't like global warming, and neither do we.

The video is also available on YouTube.
https://www.youtube.com/watch?v=kA_uaoeL3ow

Digitalisation is transforming industrial operations. What role do smart monitoring, automation, and connected air management systems play in optimizing compressor performance and plant productivity?

Digitalisation is changing the way manufacturers manage utilities, and compressed air systems are no exception. Today, customers expect greater visibility into their operations and actionable insights that help improve performance. Atlas Copco's connected solutions allow manufacturers to monitor compressor performance, energy consumption, operating conditions, and maintenance requirements in real time. Through platforms such as SMARTLINK, customers gain access to valuable operational data that helps them identify inefficiencies, anticipate maintenance needs, and prevent unplanned downtime. Automation also plays an important role in ensuring that compressed air systems operate at optimum efficiency. Intelligent controls can balance air demand, coordinate multiple compressors, and maintain consistent performance across the production facility. This not only improves reliability but also reduces energy waste.

For F&B manufacturers, where production continuity is essential, predictive maintenance and remote monitoring provide an additional layer of operational confidence. Instead of reacting to issues after they occur, manufacturers can make informed decisions based on real-time data, helping improve uptime, reduce maintenance costs and enhance overall plant productivity.

Nitrogen generation systems are gaining traction across food processing and packaging applications. What advantages do on-site nitrogen generation solutions offer compared to conventional supply methods?

Nitrogen plays an increasingly important role in food processing and packaging because it helps preserve freshness, extend shelf life, and protect product quality. Traditionally, manufacturers relied on delivered nitrogen cylinders or bulk liquid nitrogen supplies. However, many of them are now shifting towards on-site nitrogen generation.



MDG dryer: A revolutionary heat-of-compression rotary drum desiccant dryer. It delivers a guaranteed, stable Pressure Dew Point (PDP) of -40°C with near zero power consumption.

The biggest advantage of on-site generation is reliability. Manufacturers can produce nitrogen whenever they need it without depending on external deliveries or managing inventory levels. This helps eliminate supply disruptions and provides greater operational flexibility.

On-site systems also offer significant cost benefits. By generating nitrogen from compressed air, companies avoid recurring transportation, rental, and handling expenses associated with conventional supply methods. From a food safety perspective, on-site generation provides a consistent and controlled source of nitrogen for packaging and storage applications. Since the gas is produced directly at the facility, manufacturers gain better control over purity levels and supply conditions.

Looking ahead, what are Atlas Copco's key priorities for innovation and growth, and how do you see the future of compressed air and gas technologies shaping the food and beverage manufacturing sector?

Atlas Copco's key innovation and growth priorities center on energy efficiency, IoT-driven connectivity, and strict contamination control. For the F&B sector, the future lies in deploying 100% oil-free technologies and automated, on-site nitrogen generation to achieve zero-risk production and strict sustainability targets.

Our focus is on helping food and beverage manufacturers produce more with less—less energy, less waste, and lower emissions. Through innovations in energy-efficient compressors (VSD+ inbuilt HOC Dryers), smart connected technologies (Central Controllers, SMARTLink), oil-free air systems (Triple Class 0 Air Quality) and sustainable gas solutions, we see compressed air evolving from a supporting utility into a critical enabler of operational excellence and sustainability.

Smarter, Greener, Sustainable: The Future of Food Packaging



Market Growth Signals a New Packaging Era

Sustainable packaging is rapidly moving from a niche environmental initiative to a mainstream business priority across the global food, beverage and consumer goods industries. The global sustainable packaging market is forecast to grow from USD 334.43 billion in 2026 to USD 594.46 billion by 2035, registering a CAGR of 6.6% during the period. The expansion reflects growing pressure on manufacturers to reduce packaging waste, lower carbon emissions and respond to consumers who increasingly consider environmental impact when making purchasing decisions.

Sustainable packaging refers to packaging solutions designed to minimise environmental impact throughout their lifecycle—from raw material sourcing and manufacturing to transportation, use and end-of-life disposal. It encompasses materials including paper, plastic, glass and metal, while innovation is increasingly focused on recycled, recyclable, biodegradable, compostable and renewable alternatives. For food manufacturers, the challenge is to balance sustainability with the fundamental requirements of packaging: product protection, shelf life, food safety, convenience and cost efficiency.

Consumer Expectations Accelerate the Transition

Changing consumer behaviour is one of the strongest forces behind the move towards sustainable packaging. According to a report from towardspackaging, 76% of consumers actively seek sustainable products as part of their environmental commitments. This growing preference is encouraging brands to reconsider packaging formats, materials and design. Businesses are increasingly replacing conventional plastic-heavy solutions

with recyclable, plastic-free or renewable alternatives, while also reducing unnecessary layers and material usage.

At the same time, sustainability commitments are becoming more measurable at the corporate level. Packaging represents approximately USD 1 trillion in global annual spending, making it a significant area for companies seeking to reduce their environmental footprint. Industry commitments are concentrated around three major priorities: increasing recyclability and the use of recycled content, reducing overall plastic consumption, and investing in innovations that can transform how packaging is produced and used.

Lightweight and Minimalist Packaging Gain Momentum

One of the most practical approaches to sustainable packaging is lightweighting. Manufacturers are redesigning packs to use less material without compromising strength or product protection. Eliminating unnecessary layers, reducing packaging weight and adopting minimalist designs can lower raw material consumption while also reducing transportation-related emissions. This approach is particularly relevant to the food and beverage sector, where packaging must withstand handling, storage, distribution and increasingly complex e-commerce supply chains. Flexible packaging is an important part of this transition. Global flexible packaging consumption reached approximately 29.88 million tonnes in 2023, demonstrating the scale of the format and its potential role in developing high-performance, lower-material packaging solutions.

Biodegradable, Compostable and Novel Materials

Material innovation is broadening

the sustainable packaging landscape. Biodegradable and compostable materials are gaining attention because they can offer alternatives to packaging that persists in the environment for long periods. However, the future of sustainable packaging is not limited to replacing one material with another; it also involves developing packaging systems that use renewable resources, reduce waste and support effective recovery. Emerging concepts include edible packaging, seaweed-based films and mushroom-based packaging, alongside innovations in fibre-based and bio-based materials. These technologies could create new opportunities for food manufacturers, particularly in applications where packaging performance requirements can be met without relying heavily on conventional plastics.

E-Commerce Raises the Performance Challenge

The rapid growth of e-commerce is creating a new sustainability challenge. Packaging must protect products through longer and more complex distribution journeys, often involving multiple handling points. At the same time, excessive secondary packaging can increase material consumption and waste.

This is driving demand for packaging that is lightweight, durable, space-efficient and recyclable. The next generation of e-commerce packaging is therefore expected to focus on optimised dimensions, reduced void space, recyclable materials and designs that provide adequate protection without excessive material use. For food and perishable products, these requirements become even more demanding because packaging must also contribute to hygiene, product integrity and shelf-life protection.

Reuse and Recycling Become Strategic Priorities

The industry's sustainability focus is increasingly shifting beyond material substitution towards circularity. Recyclable packaging, recycled content and reusable formats are becoming important elements of corporate packaging strategies. Reuse can extend the functional life of packaging, while recycling can reduce dependence on virgin resources and divert valuable materials from disposal. However, achieving a circular packaging system requires more than redesigning the pack itself. Effective collection, sorting, recycling infrastructure and waste-management systems are essential. Packaging manufacturers and food companies therefore need to consider the complete lifecycle of their packaging rather than focusing solely on the material used.

Asia Pacific and India Emerge as Growth Engines

Asia Pacific is expected to be the fastest-

growing regional market during the forecast period, supported by increasing environmental awareness, demand for flexible packaging and the region's strong forestry and agricultural resource base. Rapid urbanisation and expanding consumer markets are further increasing demand for efficient and sustainable packaging solutions.

India is emerging as one of the fastest-growing packaging markets, supported by e-commerce expansion, urbanisation and changing consumer preferences. The country's large food and beverage industry presents significant opportunities for sustainable packaging technologies, particularly in flexible packaging, paper-based formats, recyclable structures and bio-based materials. Manufacturers and packaging technology providers are increasingly exploring solutions that can address both environmental expectations and the practical requirements of India's diverse food distribution network.

Innovation and Competition Reshape the Market

The competitive landscape includes major packaging companies such as Amcor, Smurfit WestRock, Mondi, Berry Global, Huhtamaki, Detmold Group, Pactiv, DS Smith, International Paper and Genpak. These companies are investing in material science, recyclable packaging structures, lightweight designs and other technologies designed to reduce environmental impact while maintaining packaging performance.

Competition is increasingly being shaped by three factors: product innovation, sustainability performance and responsiveness to changing consumer preferences. Established packaging manufacturers are also facing competition from newer companies using digital platforms and direct-to-consumer business models to introduce alternative packaging concepts and reach niche markets.

The Road Ahead: From Sustainable Packaging to Circular Packaging

Despite its strong growth potential, sustainable packaging faces several challenges. Environmentally preferable materials can have higher production costs, while recycling infrastructure remains uneven across markets. Manufacturers must also ensure that sustainable alternatives provide the same levels of food safety, barrier performance, shelf life, strength and convenience as conventional packaging.

The future of packaging will therefore depend on finding the right balance between environmental responsibility and functional performance. As regulations tighten and consumers become more environmentally conscious, sustainability is likely to become an integral part of packaging design rather than an additional feature. The industry's next phase will be defined not simply by replacing plastic, but by creating packaging systems that use fewer resources, generate less waste, remain economically viable and fit within a more circular economy. For food and beverage manufacturers, this transition represents both a sustainability imperative and a significant opportunity for innovation.

Information are based on a report form towardspackaging

BATCH - PRINTING / PACKAGING SYSTEMS
Supplying Quality Products Globally since 1993

TOUCH SCREEN 8-LINE INKJET PRINTER POUCH PACKING FFS HIGH QUALITY CIJ PRINTER

CROSS PAPER FOLDING ONLINE FLYING LASER

SMALL/LARGE CHARACTER HAND INKJET MAP + VACUUM TRAY SEALER 4-HEAD LIQUID FILLING

EGGS TRAY PRINTING

SKIN TRAY SEALING AUTO BOTTLE LABELING CIJ REPLACEMENT INKJET

1.7mm Throw

PAD PRINTING FEEDING CONVEYOR WITH PRINTER TABLETOP INKJET STATIC HAND LASER 100MM PRINTER

BOX LABELING EGG SORTING FLAT/ROUND LABELING POWDER/ PASTE/ LIQUID FILLING SKIN BLISTER PACKING

AIMS ADVANCED INDUSTRIAL MICRO SYSTEMS

BRANCHES: MUMBAI, DELHI, BENGALURU, KOLKATA

201 Triumph Industrial Estate, 1st Bhatti - Panch Barwadi, 7/2 Ashoka Chambers, Opp. Pillar No. 150,
Near Oberoi Mall Signal, Goregaon (E), Mumbai - 400 063. Below Rajendra Place Metro Station,
Pusa Road, New Delhi - 110068, INDIA.

(+91-22) 40123228, 42663228, 9372374470, 7715939146 (+91-11) 47539558, 9372776965

Samir Garg AIMS@gmail.com www.CodingMarking.com



Precision, Safety and Smarter Inspection: Mettler Toledo's Approach to India's Food Industry

Siddharth Kachroo, Head of Sales – Product Inspection India, Mettler Toledo

In an exclusive conversation with Food & Beverages Processing magazine, Siddharth Kachroo, Head of Sales – Product Inspection India, Mettler Toledo, discusses the company's operations and product inspection solutions for India's food and beverage industry, including checkweighing, metal detection, X-ray inspection and ProdX™ data management. He shares insights into how Mettler Toledo is supporting manufacturers of different scales with scalable automation, digitalised quality control, advanced AI-enabled inspection technologies, sustainability-focused production and improved traceability. The conversation also explores emerging opportunities across India's food manufacturing sector and the company's priorities for strengthening its local presence through technology, application expertise and long-term customer support.

Could you give us an overview of Mettler Toledo's operations in India and the key solutions you currently offer to food and beverage manufacturers across the country?

Mettler Toledo combines strong local food safety expertise in India with the technology, research and application experience of a global organisation. This means manufacturers can work with local teams who understand their production environment and requirements, while also drawing on experience from food manufacturing applications around the world.

Our "Inspect. Protect. Comply." approach brings together the inspection technologies, data and expertise manufacturers need to strengthen quality control across the production line.

Our core solutions include checkweighing, metal detection and x-ray inspection. At Anuga FoodTec India in Hall 4, Booth L-51, we will be exhibiting product inspection systems such as the C33 checkweigher to support accurate in-line weight control. On the booth we will also be exhibiting the M31R which provides reliable metal contaminant detection, plus the X12 and X13 x-ray inspection systems to address a broader range of physical contamination and product integrity requirements across packaged and bulk-flow applications.

These technologies are supported by ProdX™ data management software, which connects inspection devices and helps manufacturers automate data capture, strengthen traceability and gain better visibility of inspection performance. Together, this gives manufacturers access to both the inspection technology and expertise they need to build a quality-control approach around their particular products, processes and production priorities.

India's food and beverage industry includes both large-scale manufacturers and rapidly growing mid-sized processors. How does Mettler Toledo adapt its solutions to meet the different automation, quality, and investment requirements of these businesses?

There is no single route to automation, particularly in a market as diverse as India. A large manufacturer operating highly automated lines will often have very different requirements from a growing processor taking its first steps towards automated inspection.

For a mid-sized manufacturer, the priority may be introducing reliable inspection at a critical point in production or moving away from manual quality checks. The focus is on selecting a solution that addresses the immediate risk and delivers a practical level of automation without unnecessary complexity. At the other end of the spectrum, larger manufacturers may be looking for higher detection performance, automated testing, integrated inspection technologies or greater connectivity across multiple lines and sites. Combination systems can also be valuable where manufacturers want to bring two quality-control processes together, such as checkweighing and metal detection, while using less production space.

The important point is scalability. Manufacturers can introduce the level of inspection that reflects their requirements today, with the ability to develop their approach as production volumes, automation and quality expectations increase.

How do you view the current competition in the Indian market, and what key USP sets Mettler Toledo apart from other players in the food and beverage industry?

The Indian market is increasingly sophisticated, and manufacturers have a wide range of technology choices available to them. Our differentiation therefore goes beyond the specification of an individual machine. A major strength is our ability to combine global expertise with a strong local presence. Customers in India have access to technology and application knowledge developed across international markets, alongside local specialists who understand the realities of their production environment and relevant regulatory and customer requirements.

Our breadth of expertise is also important. Because we work across multiple inspection technologies, we can look at the manufacturer's quality-control challenge as a whole, rather than approaching it from the perspective of one particular type of equipment.

Our "Your Partner in Precision" positioning reflects the other major element of our approach, which is long-term support. From initial application advice through to installation, training, performance verification, preventative maintenance and ongoing service, our local teams support customers throughout the lifecycle of their equipment. It is this combination of global capability, local knowledge and long-term partnership that we believe sets Mettler Toledo apart.

With food safety and inspection systems becoming increasingly important, how is Mettler Toledo helping Indian food manufacturers use automation and digital technologies to improve product inspection, quality control, and production efficiency?

Automation is changing what manufacturers expect from product inspection. It is no longer only about identifying a problem and rejecting the affected product. Manufacturers increasingly want inspection systems to generate useful data, reduce manual processes and provide greater visibility of quality performance.

Our inspection systems automate core processes such as weight control and contamination detection, carrying out repeatable checks at production speed and automatically removing products that fall outside defined parameters. ProdX™ takes this further by connecting inspection devices across the line and bringing their data into a centralised view. Inspection results can be captured automatically in real time, supporting traceability and reducing reliance on manual records. It can also create clear, audit-ready reports and give production and quality teams greater visibility of inspection performance. This helps teams investigate issues more quickly, identify emerging problems and make better-informed decisions about production.

For manufacturers investing in digitalisation, the opportunity is to turn inspection data into something that can actively support quality control and line performance, rather than simply recording whether a product passed or failed inspection.

Mettler Toledo has been introducing new technologies globally, including advanced product-inspection solutions. Are there any new products, technologies or upgrades that the company plans to introduce or expand in the Indian food and beverage market in the near future?

We are continuing to introduce more advanced inspection capabilities in India, particularly in metal detection, x-ray inspection and AI-enabled analysis. The recently launched M50 R-Series is an important development in metal detection. Within the range, the M56R combines Multi-Simultaneous Frequency technology with the advanced 3S PLUS algorithm in an AI-based machine learning process. This helps the system distinguish between the signal created by challenging wet or conductive products and genuine metal contamination, improving detection sensitivity while reducing false rejects.



We are also expanding our advanced x-ray capabilities, including the X56. The X56 DXD+ combines dual-energy x-ray technology with AI-enabled image analysis for more complex inspection applications. Dual-energy technology analyses the product at two different energy levels, helping distinguish potential contaminants from the product itself where factors such as varying densities, overlapping ingredients or irregular presentation can make inspection more difficult.

These developments reflect a broader direction across product inspection, including greater use of intelligent signal and image processing to improve inspection performance while making systems easier and more efficient to operate.

How is Mettler Toledo helping food and beverage manufacturers improve sustainability by reducing product waste, material usage, and energy consumption through accurate weighing and inspection technologies?

Sustainability and production efficiency are closely linked. Reducing product giveaway, false rejects and unnecessary waste can lower costs while also helping manufacturers make better use of raw materials, packaging and energy.

Intelligent checkweighing plays an important role. By continuously monitoring pack weights, manufacturers can identify overfilling and make adjustments to filling processes, helping reduce the amount of product unnecessarily given away over a production run. Inspection accuracy matters too. Improved metal detection and x-ray performance can reduce unnecessary false rejects, meaning less good product is removed from the line and wasted. Energy consumption is also being addressed through equipment design. Sustainability targets are now incorporated into all new Mettler Toledo product development, with consideration given to areas such as power consumption, materials and the overall equipment lifecycle.

The wider aim is to look beyond the



energy consumed by an individual inspection machine. More precise and reliable production helps manufacturers reduce waste throughout the process, so the resources already used to produce, package and move a product are used more effectively.

Looking ahead, which food and beverage segments in India offer the biggest growth opportunities for Mettler Toledo, and what are the company's priorities for strengthening its presence in the Indian market?

One of the biggest opportunities is among India's growing and emerging food manufacturers that are reaching the point where they need to move from manual or basic quality controls towards automated inspection. This is less about one particular food category and more about the stage a manufacturer has reached in its development. As production volumes increase, businesses need quality-control processes that are repeatable, reliable and capable of operating at line speed.

Entry-level inspection technologies therefore have an important role. The X12, for example, is an x-ray inspection system for packaged food products that can detect a range of physical contaminants, depending on the application, while also supporting product and packaging integrity checks. It provides an accessible route into automated x-ray inspection for manufacturers looking to strengthen their quality-control capabilities.

At the same time, India's larger manufacturers are continuing to invest in higher levels of automation, connectivity and advanced inspection performance.

Our priority is to support both ends of that market. We want to help growing manufacturers take their first steps into automated inspection while continuing to bring more advanced technologies to established producers. Combined with strong local expertise and service support, this gives us significant scope to grow alongside India's expanding food manufacturing sector.

How Packaging Innovation is Transforming Instant Tea and Coffee Consumption

Mr. Parimal Shah, Founder, Cherise India



Image-unsplash

The consumer perception about ready-to-drink beverages has evolved in a quiet yet strong manner. Convenience alone is not sufficient anymore. Now, buyers desire products which can be easily prepared, transported, stored, and dependable in taste from one serving to the next. This shift has made packaging far more important than a simple outer layer. In the instant tea and coffee segment, packaging is now part of the consumption experience itself, influencing when people buy, where they use the product, and how often they return to it.

Convenience Has Become a Consumption Standard

Beverage industry experts observe that instant tea and coffee are increasingly being judged by how well they fit modern routines. A product meant for a home kitchen now also needs to work in an office drawer, a travel bag, a hotel pantry, or a shared vending corner. As a result, packaging design has moved closer to formulation strategy, with single-serve sachets, stick packs, and travel-friendly packs making instant beverages more adaptable to fast-paced lifestyles. On the contrary, refill packs and multi-pack formats serve households that value both convenience and better storage economics.

These evolved formats not only reduce the effort of the consumers but also support portion control, limit waste, and improve consistency in preparation. For consumers, that means the same taste and strength every time. Whereas, for corporate organisations, that means easier serving and fewer errors.

In a category where small differences in mix ratio can change the final drink, packaging has become a practical tool for reliability.

From Household Shelves to Shared Spaces

Packaging innovation is also reshaping how instant beverages travel across different environments. In workplaces, educational institutions, healthcare settings, hospitality spaces, and transit hubs, the demand is less about variety alone and more about speed, hygiene, and repeatability. Industry experts say this is one of the factors that is making vending-compatible packaging and large-scale institutional packaging more significant. Such packaging is designed for controlled dispensing, easy handling and smooth integration into high-usage settings.

This shift has widened the role of instant powder-based beverages made by a qualified supplier, tea and coffee premix powder solutions, and instant milk-based beverages. These products are increasingly packaged for shared use, where storage space is limited, and preparation needs to be quick. Adding to the list, flat-pack solutions and compact multi-pack formats are specifically useful in such environments, as they reduce clutter while still keeping supplies within reach. The result is a beverage system built around access and speed rather than ritual alone.

Packaging That Supports New Beverage Choices

The rise of functional ingredients, botanical

teas, and wellness-focused beverage blends has added another layer to the packaging story. These products often depend on careful protection from moisture, light, and air, making packaging a key part of product performance. According to industry experts, packaging is no longer just preserving the mix; it is also preserving the value promised by the blend. Whether the product is a botanical tea or a speciality coffee premix, the smart packaging is enhancing convenience, portability, hygiene, and accessibility for consumers, making the product easy to use in everyday settings.

Premium beverage pods and capsules have pushed this idea even further. They turn packaging into a more structured experience, one that signals precision, cleanliness, and ease. In many ways, they reflect a broader consumer habit how people are not only choosing what to drink, but also how they want it delivered. Packaging that communicates quality and trust can shape that choice before the cup is even prepared.

When Packaging Shapes Perception

Industry leaders suggest that premiumisation in instant beverages is no longer limited to product taste or ingredient claims. Presentation now carries real weight. A well-designed pack can make a premix feel more dependable, a refill pack more practical, and a capsule system more refined. Professionals increasingly highlight that shelf appeal still matters, but so does the after-purchase experience.

This is especially relevant in categories such as speciality tea and coffee premixes, where consumers often associate packaging quality with overall product quality. A clear, compact, and well-sealed format can create confidence. A poorly designed one can undermine it. In that sense, packaging has become a silent but powerful part of brand perception across the instant beverage aisle.

A Smarter Future in Less Material

Sustainability is also beginning to shape packaging decisions, though in a more practical than symbolic way. Lightweight formats, recyclable materials, material optimisation, and efficient transport-friendly designs are becoming more common because they help reduce waste and improve logistics. That balance is likely to define the next phase of instant tea and coffee packaging. The category is moving toward formats that serve multiple occasions, protect product quality, and suit the way people actually consume beverages today. In modern India, packaging is no longer standing behind the drink. It is helping define the drink's place in daily life.

Why the Future of Food Innovation Lies in Ingredients We Once Overlooked



Richa Khandelwal
MD & Founder, Leads
Brand Connect
(Amazonika Mundi India)

Food innovation is often associated with breakthrough technologies or entirely new ingredients. But sometimes, the most meaningful innovations come from looking at familiar ingredients differently.

The food industry across the globe is revolutionizing food production, processing, and consumption not just for the purpose of enhancing nutritional value but also to minimize food wastage. The result of this trend is the emergence of one of the most interesting developments within modern food science – ingredient upcycling. Upcycling is not just about making processes sustainable; rather, upcycling involves realizing the nutritional benefits in components of a plant that have been disregarded and finding ways to reintegrate them back into the food chain.

One such example is cashew fruit fibre. While most people are aware of the cashew nut, many do not know about the cashew pulp – the colorful and juicy fruit that produces the cashew nut. Although the fruit has abundant amounts of nutrients and fiber, it has long been left underused during the production process of the cashew nut. Today, advances in food science are helping unlock its potential,

transforming what was once considered a by-product into a valuable functional ingredient. This represents the kind of innovation our food systems need.

Dietary fiber is among the nutrients that most populations tend to consume much less than recommended. Meanwhile, people look out for foods that will promote healthy digestion, maintain energy levels, and improve general well-being without the use of heavily processed products.

Inclusion of cashew fruit fiber helps solve both problems. The product provides natural fiber while promoting a more circular method of food production.

What is really fascinating about this is that innovation can now be done without compromising on sustainability. The two aspects are becoming ever more interlinked.

Food manufacturers, scientists, and ingredient suppliers are investigating how to develop ingredients that will not only have nutritional functionalities but will use the resources we already grow much more efficiently. This is also a development of the changing attitudes among consumers. Consumers today are looking for an interesting story behind their ingredients. They want to know what they eat, how it is grown and why they need it in their diet.

Traceability and sustainability are now equally important considerations as flavor and convenience. Innovation, then, is no longer determined by science alone. Innovation is determined by relevance.

Does the ingredient contribute to nutrition?
Does it help address food waste?
Does it help foster sustainable agriculture?
Does it integrate well with regular diets?

When the answer to all these questions is yes, we are looking at innovation that has a lasting impact.

The future of food does not always need to be built through laboratories or manufacturing plants. The future of food can also come from the fields, overlooked ingredients, and daring to question old ideas about what is worth valuing.

Not everything that counts as a next big thing has to be completely novel. It can be finding out the remarkable value of something almost lost to us.

EXHIBITIONS & CONFERENCES 2026-2027

Anuga FoodTec India - 2026
29 Sep – 1 Oct - 2026
Bombay Exhibition Centre, Mumbai

Anuga Select India - 2026
29 Sep – 1 Oct - 2026
Bombay Exhibition Centre, Mumbai

PackVision Expo - 2026
15 – 17, October - 2026
Chennai Trade Centre

Intralogsistics & Warehousing Expo - 26
15 – 17, October - 2026
Chennai Trade Centre

FoodVision Expo - 2026
15 – 17, October - 2026
Chennai Trade Centre

drinktec India - 2026
28 -30, Oct - 2026
Bombay Exhibition Centre, Mumbai

PackMach Asia Expo - 2026
28 -30, Oct - 2026
Bombay Exhibition Centre, Mumbai

Refcold India - 2026
19 - 21, Nov - 2026
Agriculture College Ground, Pune

World SnackPro Expo - 2026
3 - 5, Dec - 2026
Ludhiana Exhibition Centre, Punjab

Annapoorna Inter Food - 2026
9 – 11, Dec - 2026
Bombay Exhibition Centre, Mumbai

Inter FoodTech - 2027
15 - 17, April - 2027
Bombay Exhibition Centre, Mumbai

Bharat Packaging Expo - 2027
30 Aug - 1 Sept - 2027
India Expo Mart, Greater Noida



info@dvrpublication.com
+91- 9555837779/9555837771
www.foodnbeveragesprocessing.com

Natural Food Ingredients: As Innovative solutions for food functionality

Dr. Harshita Sonarathi, Supreetha.S



1. Introduction:

In the current environment, consumers are getting conscious of their health and are increasingly becoming aware of the ingredients that are being included in the products they buy. Hence, there is an increasing preference for natural and clean label products that have simple and understandable ingredients and no artificial colors, flavors, preservatives, and other artificial additives. Health awareness, along with awareness of wellness and food safety, has helped consumers to prefer the products that are considered to be natural, minimally processed, and environmentally friendly.

To cater to the changing requirements of the consumers, there has been a gradual shift in the food industry from artificial additives to natural food ingredients that come from plants, animals, microorganisms, and minerals. Besides adding taste, color, texture, and increasing the shelf life of the foods,

natural ingredients also add nutritional value to the foods. Natural sweeteners, colors, preservatives, proteins, and dietary fibers are increasingly being used in dairy products, bakery products, beverages, and functional foods.

2. What Are Natural Food Ingredients ?

Natural food ingredients are chemicals that are extracted from natural resources and added to food products to improve the flavor, color, texture, nutritive value, functionality, or shelf life of foods. Natural food ingredients differ from artificial additives that are synthesized through chemical reactions since natural ingredients are extracted from plants, animals, microorganisms, or minerals with little process involved to preserve their natural state. Increasing trends toward natural food have inspired food manufacturing companies to use natural ingredients that are safe, healthy, and sustainable.

There are various sources for natural ingredients. Ingredients that come from plants are fruits, vegetables, herbs, spices, cereals, and legumes, providing natural colors, flavors, sweeteners, proteins, and dietary fiber. Turmeric, beetroot extract, stevia, and pectin are good examples of plant ingredients. Commonly used animal ingredients include milk proteins, gelatin, honey, and egg-derived ingredients, while microbial ingredients involve products of helpful microorganisms including probiotics, enzymes, organic acids, and natural preservatives such as nisin. Mineral-based ingredients come from natural mineral sources. Examples of such ingredients include salt, calcium, magnesium, and iron used for preservation, fortification, and improvement of food quality.

3. Types of Natural Food Ingredients

a) Natural Sweeteners

Natural sweeteners refer to the natural ingredients extracted from natural sources which are used to provide a sweet taste in food and beverages. These are becoming more popular as substitutes for refined sugar and artificial sweeteners owing to their health benefits and natural label. Apart from providing sweetness, these natural sweeteners contain certain bio-active compounds, minerals, or anti-oxidants which help increase the nutritional value of the foods.

Honey is one of the oldest natural sweeteners which are obtained from flower nectar by honeybees. It contains natural sugars like fructose and glucose in addition to vitamins, minerals, enzymes, and antioxidants. Jaggery is another traditional sweetener which is obtained from concentrated juice of sugarcane or palm sap. It is widely used in many countries because of its great taste and nutritional properties including minerals like iron, calcium, and potassium. Stevia is a plant-based sweetener which is obtained from the leaves of the plant *Stevia rebaudiana*. It contains steviol glycosides which impart sweetness with no or very few calories.

b) Natural colors

Natural colour are those pigments that are extracted from natural sources, including plants, algae, and microorganisms, for the purpose of making the food products visually appealing. With the rising inclination among consumers towards foods that do not contain artificial substances, there has been a rise in the use of natural colorants, which can be considered as alternatives to artificial food dyes. Not only do these pigments provide attractive colors to the products, but many of them have health benefits as well due to their antioxidant properties.

Turmeric, which is obtained from the rhizomes

of *Curcuma longa*, is known to contain a yellow pigment called curcumin. It is used for coloring dairy products, beverages, sauces, and confectionery items. The extract of beetroot consists of betalain pigments, which give a reddish-to-purplish color to the product and are used in beverages, desserts, and other processed foods. Annatto, which is obtained from the seeds of *Bixa orellana*, is used for providing yellow to orange color to the foods and is widely used in cheese, butter, baked products, and snacks. The blue-green alga called *Spirulina* contains the natural pigment called phycocyanin, which gives a blue color.

c) Natural flavour

Natural flavors are the flavoring substances which are derived from nature including fruits, plants, herbs, spices, and other natural substances. Natural flavors are used in food products to improve their taste and aroma. As the consumers have increased interest in clean-label food products, natural flavors are increasingly being used instead of flavoring substances that are artificial. The use of natural flavors is common in dairy products, beverages, bakery products, confectionery, and processed foods.

The vanilla extract is obtained from vanilla beans and gives the sweet, warm, and pleasant flavor and aroma. The usage of vanilla extract is common in ice cream, flavored milk, bakery products, chocolate, and other desserts. The fruit extracts are derived from fruits such as strawberries, mango, orange, lemon, and raspberries and give the natural flavor and aroma of fruits. Fruit extracts are increasingly being used in beverages, yogurt, ice creams, jams, and confectionery products. The herbs and spices such as mint, ginger, cinnamon, cardamom, clove, and black pepper contain volatile compounds that give unique flavors and aromas. Apart from the flavoring effect, the herbs and spices also contain antioxidant and antimicrobial compounds.

d) Natural preservatives

Natural preservatives are substances derived from natural sources and used to inhibit the growth of microorganisms and prevent food deterioration, hence increasing the shelf-life of food products. They are now more popularly used in clean label foods as a substitute for synthetic preservatives. The modes of action of natural preservatives include water reduction, reduction of pH, inhibition of microbial growth, and prevention of oxidation.

Some examples of conventional natural preservatives that aid food preservation by reducing the amount of water in foods to make it harder for microbes to grow include salt and sugar. They are commonly used in pickles, jams, jellies, and cured foods. Vinegar is made

Natural food ingredients are chemicals that are extracted from natural resources and added to food products to improve the flavor, color, texture, nutritive value, functionality, or shelf life of foods.

Natural food ingredients differ from artificial additives that are synthesized through chemical reactions since natural ingredients are extracted from plants, animals, microorganisms, or minerals with little process involved to preserve their natural state. Increasing trends toward natural food have inspired food manufacturing companies to use natural ingredients that are safe, healthy, and sustainable.

up of mostly acetic acid that reduces the pH of foods creating an unfriendly environment for spoilage and pathogenic microorganisms and is widely used in pickles, sauces, and dressings. The rosemary extract contains antioxidant compounds such as carnosic acid and carnosol that aid in preventing the oxidation of foods making them safe from rancidity especially in fatty foods. Nisin is an antimicrobial peptide produced by some strains of *Lactococcus lactis*. It has a strong antimicrobial activity against many Gram-positive bacteria.

e) Natural Functional Ingredients

Natural functional ingredients are natural constituents of foods that offer additional nutritional, physiological, or technological functions, apart from their conventional function in food. They can enhance the nutritional value, physical properties, stability, digestibility, or functionality of foods. Due to the growing demand for healthy and functional foods, functional ingredients like proteins, dietary fibers, probiotics, prebiotics, and plant-based proteins are gaining importance.

The whey proteins are good quality proteins which are extracted from milk containing all essential amino acids. These have widespread applications in dairy drinks, sports supplements, bakery products, and fortified foods because of their excellent nutritive value, easy digestibility, and functional characteristics such as emulsion and foaming. The dietary fibers are components of plant foods which are partially digested in the human body. These are derived from the sources like fruits, vegetables, cereals, oats, and legumes. The dietary fibers contribute towards digestive wellness and can also enhance the quality of food products by increasing its texture and water-binding ability. Probiotics are the live beneficial microorganisms which provide health benefits to human beings when taken in appropriate

quantities especially for gut health. The prebiotics are the specific components of the diet which act as substrates for the beneficial microorganisms in the gut. The plant proteins can be extracted from sources such as soy, pea, chickpea, lentils, and other legumes, which can provide proteins to humans.

4. Why people are interested in natural food ingredients?

The increased interest in the use of natural food ingredients has much to do with the changing consumer expectations and growing consciousness regarding the quality of food, its health benefits, and its sustainability aspects. Today, consumers are no longer interested in taste and price; instead, they ask questions about the ingredient composition of food and its production process. These new consumer trends have motivated food producers to seek for natural options in terms of colorants, flavorings, preservatives, sweeteners, and functional ingredients.

With the help of the clean label trend, manufacturers have started to focus on using simpler, more recognizable, and natural ingredients while limiting the artificial additives to a minimum. The increased focus on the wellness of consumers has been the driver for the demand for foods enriched with natural antioxidants, proteins, dietary fibers, probiotics, and other beneficial components. Minimally processed foods that consumers see as more wholesome and closer to nature have become another trend. Sustainability concerns have resulted in using plant-based, renewable, and local ingredients.

5. Applications in food industry:

Natural food ingredients have many uses within the food industry because of their ability to modify taste, appearance, functionality, nutritional profile, stability, and shelf life. Their usage is especially increasing in those foods in which consumers prefer the clean label approach with naturally sourced ingredients.

Dairy Products

There are several natural ingredients that are commonly used in yogurt, cheese, flavored milk, and ice cream production. These include natural fruit extracts, herbs, spices, and natural colors that help to add flavor and appearance to dairy products. Whey proteins and milk proteins are often added to increase the amount of protein and modify the functional properties of the products. In addition, pectin and other natural stabilizers can also be used for improving texture and stability of yogurt and ice cream. Nisin, natural preservative and antimicrobial ingredient, can also be used in some dairy products to improve their microbial stability.

Bakery and Confectionery

There are natural colors and sweeteners that are increasingly used in bread, cakes, biscuits, chocolates, candies, and other confectionery products. Some natural ingredients, such as beetroot, turmeric, annatto, and spirulina, can be used for providing attractive natural colors, while honey, jaggery, and stevia can serve as natural sweetening agents.

Beverages

A variety of natural ingredients are used in the manufacture of fruit beverages, flavored milk, functional beverages, and herbal beverages. The natural ingredients include the use of fruit concentrates, which offer natural taste, color, and nutritional value, as well as the use of botanical extracts from the use of ingredients like ginger, mint, cinnamon, and other herbs to give unique taste profiles and active ingredients. Other natural ingredients include the use of sweeteners and antioxidants for healthy and attractive beverage products.

Functional Foods

Natural functional ingredients are very significant in the development of functional foods, which offer benefits in addition to offering nutrition. Whey and plant proteins are used to make protein fortified foods and beverages, while dietary fibers are used to enhance fiber content and digestive health. Probiotics and prebiotics are used in the manufacture of fermented milk, yogurt, and functional beverages for better gut health.

6. Benefits

There are various advantages of using natural food ingredients in relation to nutrition, consumer perceptions, food quality, and environmental sustainability. The rise in the use of natural food ingredients allows the food industry to cater to the rising market

trends towards healthier and clean label foods.

1. *Nutritionally improved:* Natural food ingredients like whey protein, plant proteins, fruits, and dietary fibers could improve the nutritive value of foods.
2. *Consumer perception:* Consumers have better perceptions of naturally derived ingredients and healthy clean food products.
3. *Lower dependence on synthetic additives:* Use of natural colors, flavors, sweeteners, and preservatives could lead to lesser use of some synthetic additives.
4. *Health benefits:* Certain natural ingredients contain antioxidants, probiotics, fibers, and bioactive compounds which could be beneficial for health.
5. *Environmental sustainability:* Renewable and plant-based natural ingredients obtained from agricultural waste could lead to sustainable production of foods.

7. Challenges and Limitations

- Higher production costs
- Variability in quality and supply
- Stability during processing and storage
- Regulatory considerations

9. Future Prospects:

Future prospects of natural food ingredients look bright as consumers become more interested in purchasing healthy and environmentally friendly products. Increasing demand for natural ingredients is anticipated, which opens up possibilities for further innovations in the field of the food industry.

- *Increasing demand for clean-label foods:* Consumers' increasing awareness

will lead to the growth of demand for products consisting of natural ingredients that can be easily recognized by customers.

- *Innovative opportunities for food producers:* Producers have opportunities to produce innovative products using natural colors, flavors, preservatives, proteins, fibers, probiotics, and other plant-based ingredients.
- *Potential for sustainable and personalized nutrition:* Natural ingredients can be used to create sustainable food sources by developing plant-based and upcycled products. In the future, they can become an integral part of personalized nutrition, in which products are produced according to the unique requirements of each person.

10. Conclusion

Natural food ingredients are revolutionizing the food industry by offering healthy, functional, and naturally-derived substitutes for traditional ingredients. The increase in their usage is indicative of the rising popularity of clean-label products, better-for-you foods, and sustainable production practices. In finding equilibrium between healthiness, sustainability, quality of products, and consumer demands, natural food ingredients have opened up new avenues for innovation in the field of food products. With ongoing research and technological advancements, natural food ingredients will continue to play a vital part in food systems of the future.

Author's Bio

Dr. Harshita Sonarshi, Scientist, Dairy Technology Division, ICAR-National Dairy Research Institute, Karnal, Haryana

Supreetha.S, Assistant Director, Karnataka Cooperative Milk Producers Federation Limited, Karnataka

ADVERTISE NOW!!

SPECIAL EDITIONS

OCT - 2026
Beverages, Sweets – Snacks, Dairy, Processing, Packaging

NOV - 2026
Beverages, Processing, Packaging, Automations, Ingredients

DEC - 2026
Sweets – Snacks, Dairy, Automations, Ingredients, Processing, Packaging, Beverages,

10%
DISCOUNT

☎ 9555837771/9555837779/9999383836
 info@dvrpublication.com
 www.foodnbeveragesprocessing.com



www.interfoodtech.com
www.snackbaketec.com



Premier technology supplier fair for
food & beverage, snacks, bakery & confectionery
processing and packaging



April 15 - 17, 2027

Bombay Exhibition Center,
Mumbai

**Exhibit.
Connect.
Collaborate.
Grow.**



Supported By



✉ jc@vaexhibitions.com ☎ +91 9557328059



Natural Preservatives in Food: Emerging Alternatives for Clean-Label Food Products

By Payoshni S. Joshi

Introduction

The modern consumer wants food that is convenient, safe and long-lasting, while also preferring shorter and more recognizable ingredient lists. Food preservation is therefore essential for maintaining safety, quality and shelf life by controlling microbial spoilage, oxidative reactions and other forms of deterioration. Preservatives can inhibit the growth of spoilage and pathogenic microorganisms and, in some applications, delay oxidation and associated quality losses. At the same time, increasing consumer interest in clean-label, natural and minimally processed foods has encouraged the food industry to explore alternatives to conventional synthetic preservatives. Natural preservatives obtained from plants, animals and microorganisms including essential oils, polyphenols, organic acids and bacteriocins—have demonstrated antimicrobial and antioxidant potential. However, their effectiveness can vary with concentration, food composition and processing conditions, and some may influence flavour or other sensory attributes. This raises an important question: Can natural preservatives provide sufficient safety, stability and shelf life without compromising sensory quality?

2. What Are Natural Preservatives?

Natural preservatives are substances obtained from natural sources that help delay food spoilage and maintain safety and quality by inhibiting microorganisms, oxidation or other deterioration reactions. They may originate from plants, animals, microorganisms or fermentation processes. Plant-derived examples include essential oils, polyphenols and flavonoids, while animal- and microbial-derived compounds include lysozyme, chitosan, nisin and other antimicrobial

Natural preservatives protect foods through several mechanisms that can act against microorganisms and chemical deterioration. Antimicrobial compounds such as essential-oil components and bacteriocins may disrupt microbial cell membranes, alter membrane permeability, interfere with enzymes and essential cellular processes, and ultimately inhibit microbial growth. Antioxidant compounds, including polyphenols and other plant bioactives, can scavenge free radicals and slow lipid oxidation, thereby helping preserve food colour, flavour and nutritional quality.

substances. Fermentation can also generate preservative compounds such as lactic acid, acetic acid and bacteriocins. Synthetic preservatives are manufactured through chemical processes, whereas naturally occurring preservatives are substances already present in foods or natural biological systems. Nature-identical compounds are chemically produced substances that are structurally identical to compounds found in nature. Importantly, “natural” does not automatically mean safer or more effective; appropriate

dosage, toxicity, regulatory approval, food application and sensory effects must all be considered.

3. Why Is the Food Industry Looking for Alternatives?

The growing interest in natural and minimally processed foods is encouraging the food industry to reconsider conventional approaches to preservation. Consumers increasingly look for clean-label products, shorter ingredient lists, greater ingredient transparency and fewer artificial additives. The clean-label movement is associated with perceptions of naturalness, simplicity and reduced processing, although there is no universally accepted definition of “clean label.” At the same time, manufacturers must maintain food safety, adequate shelf life and stable quality throughout processing, storage and distribution while reducing food losses and waste. Natural preservation systems are therefore being investigated as alternatives or complements to conventional preservatives. However, replacing synthetic preservatives is not straightforward. Natural alternatives may require higher concentrations, provide shorter shelf life or affect flavour, aroma and other sensory properties. Their performance can

Applications in Different Food Products

Food category	Possible natural preservative approach
Bakery products	Organic acids, plant extracts and essential oils
Meat products	Rosemary extract, essential oils and natural antimicrobial compounds
Beverages	Organic acids and selected plant extracts
Dairy products	Nisin and selected natural antimicrobial compounds
Sauces & dressings	Organic acids, spices and plant extracts
Fresh produce	Edible coatings and essential oils
Snacks & oil-rich foods	Rosemary extract and other natural antioxidants

also depend on the food matrix, processing conditions and regulatory requirements. Thus, clean-label preservation aims to balance consumer expectations for recognizable ingredients with the industry's fundamental requirements for safety, stability and shelf-life extension.

5. How Do Natural Preservatives Work?

Natural preservatives protect foods through several mechanisms that can act against microorganisms and chemical deterioration. Antimicrobial compounds such as essential-oil components and bacteriocins may disrupt microbial cell membranes, alter membrane permeability, interfere with enzymes and essential cellular processes, and ultimately inhibit microbial growth. Antioxidant compounds, including polyphenols and other plant bioactives, can scavenge free radicals and slow lipid oxidation, thereby helping preserve food colour, flavour and nutritional quality. Organic acids contribute to preservation by lowering food pH and, depending on the acid and conditions, entering microbial cells in their undissociated form and disturbing cellular metabolism. In addition, edible coatings and films can create a physical barrier that reduces the transfer of oxygen and moisture between food and its environment. These mechanisms may operate individually or synergistically, depending on the compound, concentration and food matrix. Thus, natural preservation can be viewed as: Natural compound → target microorganism or oxidation pathway → inhibition → delayed deterioration → extended shelf life.

6. Applications in Different Food Products

Natural preservatives can be incorporated into a wide range of foods, but their effectiveness is food-matrix dependent. Factors such as pH, water activity, fat content, processing conditions, packaging and storage temperature can influence their performance. Therefore, a preservative that performs well in one product may not provide the same protection in another.

In bakery products, organic acids and plant-derived compounds may help control microbial spoilage, while rosemary and other antioxidants can delay oxidation in meat and oil-rich foods. Nisin has applications in selected dairy and other foods for controlling susceptible bacteria. Edible coatings containing natural antimicrobial compounds may also help protect fresh produce. However, successful application requires optimization of concentration and processing conditions, followed by evaluation of microbial safety, shelf life and sensory quality. Thus, natural preservation should be considered a food-specific strategy rather than a universal replacement for synthetic preservatives.

4. Major Types of Natural Preservatives

Category	Examples / Sources	Antioxidant / Antimicrobial Action	Application Potential	Major Limitations / Considerations
A. Plant-derived preservatives	Rosemary extract, green tea extract, clove, cinnamon, oregano, thyme, garlic, turmeric	Rich in bioactive compounds such as phenolic acids, flavonoids, tannins and terpenes. They can scavenge free radicals, delay lipid oxidation and inhibit several spoilage and pathogenic microorganisms.	Can be incorporated into meat products, bakery products, oils, beverages, sauces and other foods. Rosemary and green tea extracts are particularly studied for antioxidant protection.	Activity varies with extraction method, concentration and food matrix. High concentrations may produce undesirable taste, colour or aroma.
B. Essential oils	Oregano, thyme, cinnamon, clove and lemon-grass oils	Their volatile compounds, such as carvacrol, thymol, eugenol and cinnamaldehyde, can disrupt microbial cell membranes and exhibit antioxidant activity.	Potential applications include meat, dairy products, bakery products, sauces, beverages and active packaging.	Strong flavour and aroma can limit the concentration that can be used without affecting sensory quality. Their volatility and sensitivity to processing conditions can also reduce effectiveness.
C. Organic acids and natural sources	Acetic acid (vinegar), lactic acid (fermentation), citric acid (citrus fruits) and malic acid (apples and other fruits)	Lower food pH and create conditions that are unfavorable for many microorganisms. The undissociated form of some organic acids can enter microbial cells and interfere with cellular metabolism.	Widely used in beverages, sauces, pickles, dressings, fermented foods and other acidified products.	Effectiveness depends on pH, concentration, food composition and target microorganism. Excessive levels may negatively affect taste.
D. Fermentation-derived preservatives	Nisin, natamycin and other antimicrobial metabolites produced by microorganisms	Nisin, a bacteriocin produced by <i>Lactococcus lactis</i> , is active mainly against many Gram-positive bacteria. Natamycin, produced by <i>Streptomyces</i> species, is used particularly for controlling moulds and yeasts. Fermentation can also generate organic acids and other antimicrobial metabolites.	Useful for cheese and dairy products, fermented foods, meat products and surface preservation, depending on the compound and regulatory approval.	Activity may be selective toward particular microorganisms. Effectiveness can be influenced by food composition, pH and storage conditions. Regulatory requirements vary according to the application.
E. Chitosan	Obtained mainly by deacetylation of chitin, which occurs in crustacean shells and can also be obtained from fungal sources.	Exhibits antimicrobial activity through interactions between its positively charged groups and negatively charged microbial cell surfaces. It also has antioxidant properties under certain conditions.	Its film-forming ability makes it attractive for edible coatings and active food-packaging films. It can help create a protective barrier around foods and may be combined with other antimicrobial compounds.	Performance depends strongly on molecular weight, degree of deacetylation, pH and food matrix. Consumer acceptance and allergen/source considerations may also need evaluation.

7. Emerging Technologies to Improve Natural Preservation

Emerging food technologies are helping overcome some of the limitations associated with natural preservatives, particularly their instability, volatility, strong sensory characteristics and limited bioavailability. Nanoencapsulation can protect sensitive bioactive compounds from degradation and may provide greater stability and controlled release during food storage. Microencapsulation similarly protects natural compounds, improves handling and can help

mask undesirable flavours or aromas. Active packaging provides another approach by incorporating antimicrobial or antioxidant substances into packaging materials, allowing them to interact with the food or its surrounding atmosphere. Edible coatings can carry natural antimicrobial or antioxidant compounds while creating a protective barrier that can reduce moisture and gas transfer, making them particularly promising for fresh produce. Another important concept is hurdle technology, in which several mild preservation factors such as pH control, refrigeration,



reduced water activity, natural antimicrobials and appropriate packaging are combined to inhibit microorganisms more effectively. Thus, the future of clean-label preservation may lie not in replacing synthetic preservatives one-for-one, but in integrating natural compounds with processing, encapsulation and packaging technologies.

8. Challenges and Limitations

Despite their potential, natural preservatives have several limitations that can affect their practical application. Plant extracts may show variable composition and preservative activity because of differences in plant variety, growing conditions and extraction methods. Some natural compounds have strong flavours, aromas or colours that may affect consumer acceptance. Their stability can also decrease during processing and storage, while interactions with food components may reduce their effectiveness. Certain natural ingredients can be relatively expensive, and achieving adequate preservation may require concentrations that affect sensory quality. In addition, regulatory approval and safety assessment are essential before commercial use. In some applications, natural systems may also struggle to provide the same shelf life as established conventional preservation systems.

9. Future Outlook

The future of natural food preservation is likely to focus on integrated and precisely designed preservation systems rather than dependence on a single ingredient. Combining natural antimicrobials, plant-based antioxidants and fermentation-derived compounds with encapsulation technologies, active and intelligent packaging, and edible coatings may improve stability and controlled delivery. Precision preservation could help select the appropriate preservative concentration and processing conditions for specific food matrices, while hurdle technology can combine several mild preservation factors to achieve effective microbial control. These approaches may support the development of foods with cleaner and more recognizable ingredient lists without compromising safety or shelf life. However, successful commercial application will require systematic evaluation of efficacy, toxicity, sensory acceptance, stability, regulatory compliance and cost. Thus, natural preservation is likely to become an important component of next-generation food formulation, but continued scientific validation is essential.

10. Conclusion

Natural preservatives offer promising options for developing clean-label foods, particularly through their antimicrobial and antioxidant properties. However, their effectiveness depends on factors such as concentration, mechanism of action, food matrix, processing conditions, storage and sensory acceptance. Emerging approaches including encapsulation, edible coatings, active packaging and hurdle technology can help improve their stability and preservation performance. Therefore, natural preservation should not be viewed simply as replacing synthetic preservatives with natural ingredients. Instead, the future of clean-label preservation is likely to depend on smart combinations of natural compounds, processing methods and packaging technologies, supported by rigorous scientific validation.

References for the article are available upon reader request.

Author's Bio: Payoshni S. Joshi is a technical writer specializing in the food and beverage industry. She regularly contributes authoritative articles to Food & Beverages Processing magazine, highlighting innovations, best practices, and emerging trends that are shaping the global food and beverage landscape

ADVERTISER'S INDEX

COMPANY NAME	P.N
ADVANCED INDUSTRIAL MICRO SYSTEMS	53
ALI GROUP	12
ANNAPOORNA INTER FOOD - 2026	73
ANUGA FOODTEC INDIA - 2026	46-47
ANUGA FOODTEC INDIA DAIRY - 2027	74
ANUGA SELECT INDIA - 2026	4
A.T.E. HUBER ENVIROTECH PRIVATE LIMITED	29
BLUECRAFT AGRO PVT. LTD.	75
BMB	14
BONFIGLIOLI TRANSMISSIONS PVT. LTD.	2
BORELLI GROUP	9
DRINKTEC INDIA - 2026	18
DYNATECH MARKETING COMPANY	7
FLIR SYSTEMS INDIA PVT. LTD.	76
INOXPA INDIA PVT. LTD.	15
ITALIAN TRADE AGENCY (ITA)	8
JFM VERBRUGGEN INDIA PVT. LTD.	5
MANN+HUMMEL WATER & MEMBRANE SOLUTIONS	11
NORD DRIVESYSTEMS	23
PACKVISION EXPO - 2026	65
PIGO SRL	10
PWS ENGINEERS PVT. LTD.	19
SEW EURODRIVE	41
SNACKS & BAKETEC - 2027	61
TECALIT	13
TIMKEN	37
TRELLEBORG SEALING SOLUTIONS	3
WINDSOR CHOCOLATIER	25

Visit Logistics, Packaging & Food Expo



**INTRALOGISTICS &
WAREHOUSING
EXPO**



**PackVision
Expo**



**FOODVISION
expo**

15 16 17 October 2026

Chennai Trade Centre, Chennai

BOOK YOUR BOOTH



Vaishali Arya
99113 35153

Shivalika Mehra
88605 05806



Cold Chain 2.0: How Smart Warehousing is Redefining Perishable Food Logistics

Ritesh Verma



The Cold Chain Is Entering a New Era

Perishable food logistics has traditionally been built around one fundamental requirement: maintaining the right temperature. For products such as fresh fruits and vegetables, dairy, meat, seafood, frozen foods and ready-to-eat products, temperature control remains critical. However, today's food supply chains demand much more than refrigerated storage and transportation. Manufacturers and distributors are increasingly looking for greater visibility, faster operations, lower energy consumption, improved traceability and the ability to respond to supply-chain disruptions in real time.

This shift is giving rise to Cold Chain 2.0, where conventional cold-storage facilities are evolving into smart, digitally connected warehouses. Technologies such as IoT sensors, artificial intelligence, cloud-based monitoring, warehouse management systems, robotics and automated material handling are transforming cold-chain operations from reactive systems into predictive and data-driven networks.

IoT Brings Real-Time Visibility Inside the Cold Chain

One of the biggest challenges in perishable food logistics is the lack of continuous visibility. A product may pass through several stages, from processing and packaging to cold storage, transportation, distribution and retail. Any temperature deviation during this journey can affect quality and shelf life, while delayed detection can turn a small problem into significant product loss.

IoT-enabled sensors are changing this equation. Sensors installed across cold rooms, storage racks, transport vehicles and packaging environments can continuously monitor temperature, humidity, door openings, equipment performance and other critical parameters. The data can be transmitted to cloud-based platforms, allowing warehouse operators and food manufacturers to monitor conditions remotely. Instead of discovering a temperature problem during a manual inspection, operators can receive an alert as soon as conditions move outside the defined range. This enables faster intervention and helps prevent quality deterioration before products are compromised.

AI Turns Warehouse Data into Action

While IoT provides the data, artificial intelligence can help transform that information into actionable intelligence. Modern cold-chain facilities generate large volumes of operational data, covering refrigeration systems, inventory movement, energy consumption, temperature patterns and equipment performance.

AI-powered analytics can identify patterns that may not be immediately visible to warehouse personnel. For example, predictive systems can analyse refrigeration performance and detect signs of potential equipment failure before a breakdown occurs. This enables maintenance teams to move from reactive repairs to predictive maintenance. AI can also support inventory management by analysing product demand, remaining shelf life, historical

sales and storage conditions. This can help warehouses prioritise products that need to be dispatched sooner, reducing the risk of expiry and food waste.

For food manufacturers dealing with short shelf-life products, such intelligence can become a significant competitive advantage.

Automation Makes Cold Warehouses Faster and Safer

Cold-storage environments present unique challenges for workers. Low temperatures, limited visibility, heavy packaging and repetitive movement can make material handling demanding. Automation is therefore becoming an increasingly important component of modern cold-chain facilities.

Automated storage and retrieval systems, conveyors, automated guided vehicles and autonomous mobile robots can move products between receiving, storage, picking and dispatch areas with limited manual intervention. Robotic palletising and depalletising systems can further reduce repetitive handling while improving consistency. Automation can also improve warehouse utilisation. High-density automated storage systems can make better use of available vertical space, allowing operators to store more products within the same facility footprint. For businesses facing high real-estate and energy costs, improved space utilisation can have a direct impact on operational efficiency.

Smart Warehouse Management Improves Inventory Control

A modern cold warehouse is not simply a building filled with refrigerated products. It is an information system as much as it is a physical facility. Warehouse Management Systems (WMS) integrated with sensors, ERP platforms and supply-chain software can provide a real-time picture of inventory across the facility. Operators can track where a product is stored, when it entered the warehouse, its batch information, expiry date and movement history.

For perishable products, inventory strategies such as FEFO (First Expired, First Out) become particularly important. Digital systems can automatically identify products approaching their expiry dates and prioritise them for picking and dispatch. This reduces dependence on manual inventory checks and helps manufacturers maintain better control over product movement, batch traceability and stock rotation.

Breaking the Cold Chain Without Losing Control

Maintaining temperature integrity is particularly challenging during loading,

unloading and product transfer. Even when refrigeration systems operate efficiently, prolonged door openings or delays at loading docks can expose products to unsuitable conditions. Smart warehouses are addressing these weak points through automated doors, temperature-controlled loading areas, dock-management systems and real-time alerts. Sensors can monitor temperature fluctuations and door activity, while automated systems can reduce unnecessary exposure to ambient conditions.

Digital tracking can also create a temperature history for products throughout their journey. This provides manufacturers with greater visibility and can support quality assurance, regulatory compliance and customer confidence.

Energy Efficiency Becomes a Cold-Chain Priority

Cold storage is inherently energy-intensive because refrigeration systems must operate continuously. Rising energy costs and increasing pressure to reduce carbon emissions are therefore making energy efficiency a strategic priority for warehouse operators. Smart technologies can help optimise refrigeration performance by analysing temperature requirements, equipment loads, occupancy patterns and external conditions. Rather than operating every system at maximum capacity continuously, intelligent controls can adjust operations according to actual requirements.

Energy-efficient refrigeration equipment, variable-speed compressors, heat recovery systems, improved insulation, LED lighting, automated doors and renewable energy integration can further reduce the environmental footprint of cold-storage facilities. For larger food companies, the integration of solar power, energy-management systems and battery storage can also support their broader sustainability strategies.

Reducing Food Waste Through Better Logistics

Food waste is one of the most significant challenges associated with perishable products, and weaknesses in logistics can contribute substantially to losses. Temperature excursions, incorrect stock rotation, transportation delays and poor demand forecasting can all shorten product shelf life. Cold Chain 2.0 approaches waste reduction as a data problem as much as a storage problem. By combining real-time temperature information with inventory data, AI-based demand forecasting and automated stock rotation, businesses can make better decisions about which products should be stored,

Increasing automation does not necessarily mean eliminating people from cold-chain operations. Instead, the role of employees is changing. Workers can move away from repetitive manual handling and spend more time on supervision, quality control, maintenance, exception management and decision-making. This transition will require investment in workforce training. Employees need to understand digital warehouse systems, data dashboards, automated equipment and new safety procedures. Technology suppliers and food manufacturers will therefore need to consider skills development alongside equipment investment.

moved or dispatched first. Early identification of temperature deviations can also allow operators to isolate affected batches before the problem spreads across the inventory. The objective is not simply to keep products cold, but to preserve their quality and usable shelf life for as long as possible.

Traceability Becomes a Competitive Advantage

Food safety and traceability are becoming increasingly important across the global food industry. Manufacturers need to know where raw materials originated, how products were processed, where they were stored and how they moved through the supply chain.

Smart cold-chain systems can connect these different stages through digital records. Batch numbers, temperature data, warehouse movements and transportation information can be linked to individual products or shipments. This level of traceability can help companies respond more quickly to quality incidents, conduct targeted recalls and demonstrate compliance with food-safety requirements. It can also provide customers with greater confidence in the integrity of temperature-sensitive products.

From Smart Warehouse to Connected Supply Chain

The real potential of Cold Chain 2.0 lies in connecting individual technologies rather than implementing them in isolation. An IoT sensor becomes more valuable when its data is connected to a WMS. A WMS becomes more powerful when integrated with AI-based forecasting. Automation becomes more effective when robots receive real-time instructions from intelligent warehouse systems.

This creates an interconnected ecosystem in which physical products and digital information move together. A food manufacturer could, for example, monitor the temperature of a product during transportation, receive the shipment automatically into a smart warehouse, assign

it to an optimal storage location, track its remaining shelf life and automatically prioritise it for dispatch based on demand and expiry data. Such integration moves the cold chain from a series of disconnected processes towards a coordinated digital supply network.

The Human Role Is Evolving, Not Disappearing

Increasing automation does not necessarily mean eliminating people from cold-chain operations. Instead, the role of employees is changing. Workers can move away from repetitive manual handling and spend more time on supervision, quality control, maintenance, exception management and decision-making.

This transition will require investment in workforce training. Employees need to understand digital warehouse systems, data dashboards, automated equipment and new safety procedures. Technology suppliers and food manufacturers will therefore need to consider skills development alongside equipment investment.

The Road Ahead for Cold Chain 2.0

The future of perishable food logistics will increasingly depend on the ability to combine temperature control, digital intelligence, automation and sustainability. Smart cold warehouses are emerging as strategic assets rather than simply storage facilities, helping food businesses protect product quality while controlling operational costs and reducing waste.

As food supply chains become more complex and consumer expectations around freshness, safety and sustainability continue to rise, traditional cold storage alone will no longer be enough. The competitive advantage will belong to companies that can see what is happening across their cold chain, predict what is likely to happen next and respond quickly. Cold Chain 2.0 is ultimately about turning refrigeration into intelligence. By connecting IoT, AI, automation, advanced warehouse management and energy-efficient technologies, the food industry can build cold chains that are not only colder and faster, but smarter, more resilient and more sustainable.



Krones Opens New Plant in India



With the official opening of its new plant in Vemagal, near Bangalore, on 19 August, Krones is further expanding its presence in India. The new site enables the company to support customers even more closely and strengthen its position in one of the world's most important growth markets for the beverage, food and packaging industries.

One of the most dynamic growth markets

India is playing an increasingly important role for Krones. The Group is already represented in the country through several companies and centres of competence. With the new production facility, Krones is adding another important element to this network and making a targeted investment in the future of the Indian market.

"India is one of the world's most dynamic growth markets. With the opening of this facility, we are reaffirming Krones' long-term commitment to the country and creating a

platform for future growth, innovation and value creation. We see India as a strategic market and an important part of Krones' global growth journey", says Ralf Goldbrunner, Member of the Executive Board of Krones AG.

Krones already operates several locations in India, including Krones India and Krones Digital Solutions India in Bangalore, Krones Processing India in Hyderabad and System Logistics India in Mumbai. The new facility in Vemagal further expands this footprint and underscores the company's long-term commitment to the Indian market.

Investing in People and Long-Term Growth

"The real significance of this facility lies not in its buildings, machinery or technology, but in the people, partnerships and shared commitment that made it possible. This achievement reflects the dedication of our teams and marks the beginning of the next chapter of the Krones story in India," says Thomas Wolter, Managing Director of Krones Machinery India.

The opening of the plant marks another important milestone in Krones' development in India. With this new facility, the company is laying the foundations for further growth while underlining its long-term commitment to a market that is becoming increasingly significant for the global beverage, food and packaging industries.

in waste, rework, quality deviations or production interruptions.

Recipe-based operator guidance directly at the machine

Changeover Assist addresses these challenges with digital, recipe-based operator guidance directly on the SmartControl HMI. The application displays only the steps relevant to the specific product changeover, supports multiple languages and can be enhanced with images, videos and additional work instructions. Each completed step is confirmed and documented, increasing transparency, traceability and process reliability throughout the changeover. The machine can only restart once all required steps have been properly confirmed.

"With Changeover Assist, we make valuable machine and process knowledge available at all times, which helps our customers carry out changeovers safely and efficiently, regardless of individual experience levels," says Michel Theiss, Product Manager Digital Solutions at GEA. "The result is fewer operator errors, less material and food waste, faster onboarding of new employees and greater overall production reliability."

Centralized management of changeover instructions via InsightPartner

A key component is the integration with the cloud-based InsightPartner solution. Customers can centrally manage and update their own changeover instructions there and enrich them with multimedia content. This creates a digital knowledge base that can be used across sites and continuously developed over time. In addition, the new InsightPartner Notification Service, together with the corresponding Mobile App, provides an integrated solution for sending real-time machine notifications directly to responsible personnel.

Digital process reliability and consolidated line expertise

Changeover Assist is another key element of GEA's digitalization strategy. The application supports the company's goal of developing connected, user-friendly and process-reliable solutions for food processing and packaging, helping strengthen customers' industrial value creation over the long term. Changeover Assist is being continuously developed further at the Biedenkopf-Wallau site. This development work is increasingly benefiting from the planned centralization of customer-facing functions at the site, creating greater proximity to end customers and better conditions for integrated working. By April 2028, functions including sales, service and customer final acceptance testing are to be consolidated at the site in Hesse.

GEA expands digital portfolio in Food segment: Changeover Assist reduces errors, waste and downtime during product changeovers

GEA is introducing Changeover Assist, a new digital application that provides standardized support for product and recipe changeovers on SmartControl-based machines. The software guides operators step by step through the changeover process, helping reduce operator errors, product waste and unplanned downtime.

The digital assistant was developed primarily at GEA's production site in Biedenkopf-Wallau (Germany), the company's center of excellence for horizontal packaging machines. The software is initially available for GEA PowerPak thermoformers and the GEA MaxiFormer drum former, with a phased rollout to additional machines, including the GEA OptiSlicer, planned. Going forward,

GEA also intends to consolidate the slicing and loading systems portfolio of its Food Solutions business unit in Biedenkopf-Wallau. This will help reduce interfaces and better align future development work for individual machines as well as integrated line solutions.

Product changeovers: a critical process step in food production

For many food manufacturers and packaging operations, product and format changeovers are among the most demanding steps in industrial production. High employee turnover, the use of seasonal labor and growing product variety add further complexity. Every deviation, such as using the wrong packaging materials or skipping individual changeover steps, can result

EPSRR Partners with Axton Capital to Expand F&B Concepts in Sri Lanka and Oman



Colombo and Muscat, with plans to explore further opportunities across Sri Lanka, Oman and other selected international markets.

EPSRR, which has previously invested in and developed Club Sulaimani Food & Beverages LLP and its Club Sulaimani® and CS Signature® brands in India, is also developing EPSRR Le Bistro® for international markets. Chairman Riyas Kalliyath and CEO Anand R. Iyer described the agreement as a major step in the company's international expansion strategy, beginning with Oman and Sri Lanka and potentially extending to GCC, European and American markets. Axton and JMR Director Malith Perera said the group's established presence and local knowledge in both markets would provide EPSRR with an operating platform to accelerate the development of its F&B concepts.

EPSRR Holdings Private Limited (EPSRR) has signed a Memorandum of Understanding (MOU) with UK-based Axton Capital to develop and expand food and beverage concepts in Sri Lanka and the Sultanate of Oman. The partnership will be implemented through Axton subsidiary J M Robertson & Company Limited (JMR), which operates Department of Coffee cafes in Sri Lanka and Oman and brings more than 180 years of coffee-trading and regional operating experience. The collaboration will initially focus on

Avery Dennison Inaugurates New Distribution Centre in Bengaluru to Strengthen its 'Closer to Customers' Commitment



Avery Dennison South Asia, a leader in materials science and digital identification solutions, inaugurated its new Distribution Centre in Bengaluru, a significant step in the company's ongoing commitment to being closer to its customers. The new facility is more than double than its earlier facility and is designed to support growing demand across Labels, Intelligent Labels, Tapes, Graphics and Reflective solutions. The expanded facility reflects Avery Dennison's strategy of scaling its infrastructure ahead of demand, enabling the company to improve delivery speed and reliability as its business continues to grow. The facility is also home to a dedicated Customer Experience Center, which provides brand owners with an opportunity to explore Avery Dennison's latest solutions and innovations first-hand.

Speaking at the inauguration, Saurabh Agarwal, Vice President and General Manager, South Asia, Avery Dennison, said, "India remains one of our fastest-growing and most strategic markets globally. This investment

goes beyond expanding warehousing capacity, it reinforces our long-term commitment to the region. As customer demand for speed and reliability accelerates, Avery Dennison is ensuring we do not just deliver world-class solutions, but stand right beside our customers where they need us most.

Adding to this, Hemant Tewari, Operations and Supply Chain Director, South Asia, said, "Across the materials and labeling industry, agile supply chain has become as important as product quality itself, customers today expect consistency and reliability at a pace. This new facility is a direct response to that shift. It's not just about adding capacity, it's about rethinking how we could serve our customers better".

The new facility is strategically located with excellent connectivity via peripheral roads, enabling faster, more efficient movement of goods across India. Being situated outside city limits also frees operations from city timing restrictions that typically constrain last-mile logistics, a key enabler for the company's goal of achieving one-day delivery within Bangalore. With this inauguration, Avery Dennison reinforces its long-term commitment to the Indian market, building infrastructure that supports both current operations and future growth across its key business verticals.

Government of Odisha Signs MoU with Hindustan Coca-Cola Beverages



Reinforcing Odisha's position as a preferred destination for manufacturing and industrial investments, the Government of Odisha today signed a Memorandum of Understanding (MoU) with Hindustan Coca-Cola Beverages (HCCB) for the company's manufacturing facility at Khordha.

The MoU was exchanged between Shri Mohan Charan Majhi, Hon'ble Chief Minister of Odisha, and representatives of Hindustan Coca-Cola Beverages (HCCB), including Mr. Harsh Bhutani, Chief Financial Officer, and Mr. Himanshu Priyadarshi, Chief Public Affairs, Communications & Sustainability Officer, during Odisha FoodPro 2026, organised by the Government of Odisha in association with the Industrial Promotion and Investment Corporation of Odisha (IPICOL).

The exchange took place in the presence of Shri Sampad Chandra Swain, Hon'ble Minister of State (Independent Charge), Industries, Government of Odisha; Mr. Hemant Sharma, IAS, Additional Chief Secretary, Industries Department, Government of Odisha; Mr. D. Prashanth Kumar Reddy, IAS, Managing Director, IDCO and Ms. Aboli Sunil Naravane, IAS, Director of Industries and Managing Director, IPICOL (additional charge).

The investment marks another significant milestone in Odisha's efforts to attract large-scale manufacturing investments and strengthen the state's food processing and beverage ecosystem. The proposed expansion of HCCB's manufacturing facility in Khordha is expected to support industrial development and contribute to the state's long-term economic growth. Hindustan Coca-Cola Beverages has maintained a strong presence in Odisha through its manufacturing operations at Khordha. The proposed expansion will further strengthen the company's manufacturing footprint in the state while supporting increasing consumer demand and contributing to Odisha's vision of becoming a leading destination for manufacturing and industrial investment.

Amcor and Tiptree Partner on RecyClass-Certified Shrink and Stretch Films Ahead of 2027 Plastic Packaging Tax Shift



Amcor, a global leader in developing and producing responsible packaging solutions, has partnered with Tiptree, the preserves and spreads brand owned by Wilkin & Sons, to deliver certified 30% post-consumer recycled (PCR) films for Tiptree's shrink films and pallet stretch wrap, helping the brand prepare for upcoming UK Plastic Packaging Tax (PPT) changes while maintaining logistics packaging performance.

Tiptree has transitioned to Amcor's RecyClass-certified collation shrink film and Bontite® Sustane® stretch wrap, both incorporating 30% PCR content. Designed to maintain performance while using certified recycled material, the films help support operational efficiency, load stability and packaging performance requirements while contributing to total cost of ownership objectives.

Tiptree's move comes ahead of significant UK PPT changes due to take effect from April 2027, when post-industrial recycled (PIR) content will no longer count toward the 30% minimum recycled plastic threshold and only post-consumer recycled (PCR) content will be accepted. As a result, Tiptree selected Amcor's collation shrink film and Bontite Sustane stretch wrap because their PCR content levels are independently certified, supporting accurate sustainability reporting.

Both films are produced at Amcor's UK sites in Leominster and Bromborough and are RecyClass Recycled Plastics Traceability Certified (EN15343). The certification provides independent verification of the PCR plastic incorporated into each film and confirms that recycled materials are fully traceable through controlled production processes aligned with recognized European standards.

Manuel Martinez, packaging buyer at Wilkin & Sons said: "Our relationship with Amcor is collaborative, so faced with upcoming PPT changes it was natural to lean on Amcor's knowledge and expertise. We've been incorporating recycled content into our packaging for some time and having that content independently verified via RecyClass, with certification, gives us confidence in the traceability of the material. Just as important, we have maintained the packaging performance and the

level of operational efficiency that our business depends on."

Gabrielle Ditsch, sales director at Amcor added: "We've worked with Tiptree for many years. We're always looking at ways we can help customers increase the use of recycled content in their packaging without compromising on performance. Incorporating PCR into shrink and stretch films can be technically challenging, which is why our focus has been on delivering solutions that maintain the strength, consistency and efficiency customers expect." With legislative changes continuing to shape the packaging supply chain, many businesses are reviewing their material choices. Amcor's ability to combine high-performance films with independently certified recycled content, validated through testing and customer trials, is one of the reasons many brands rely on the company's expertise.

The company has a strong UK manufacturing footprint with many certified sites and robust traceability systems, supported by expertise in material science, recycling and regulatory alignment.

"Customers are increasingly looking beyond recycled content percentages alone and asking where that material comes from, how it is verified and how it performs in practice," said Gabrielle Ditsch. "That's why certification, traceability and product performance all matter. By combining independently certified PCR content with high-performing film technologies, we can help customers meet evolving requirements while supporting packaging efficiency, product protection and total cost of ownership."

AUM Premium Partners with Scrapbuddy to Introduce Doorstep Bottle Recycling



AUM Premium, India's first mindful hydration brand making natural Himalayan spring water accessible, born at the confluence of Himalayan purity and conscious living brand, has partnered with Scrapbuddy as its waste management partner to launch a doorstep recycling initiative, making it easier for consumers to recycle their bottles responsibly while encouraging a culture of mindful hydration and sustainable consumption. As part of the initiative, AUM Premium customers can book a doorstep

pickup for their used bottles through the brand's website. Scrapbuddy will collect the bottles either on the same day or at a time scheduled by the customer and facilitate their recycling through its established recycling ecosystem, encouraging greater participation in sustainable waste management.

Commenting on the partnership, Jagriti Motwani, Founder & CEO, AUM Premium, said "At AUM Premium, we believe that mindful choices shouldn't stop once the bottle is empty. Through this partnership we're making responsible disposal simple and accessible, encouraging consumers to recycle without the hassle. It's a simple step that can collectively make a meaningful difference towards

building more sustainable everyday habits."

Speaking on the announcement, Sachin Garg, Director, Scrapbuddy said, "Every bottle collected at the doorstep is a bottle that doesn't end up in a landfill or a water body. Partnering with AUM Premium lets us plug directly into consumers' daily routines, so recycling becomes a simple, scheduled habit rather than an afterthought. We're glad to extend our collection network to support this shift toward a more circular, responsible packaging ecosystem"

With this initiative, AUM Premium continues to encourage more sustainable consumer habits by making recycling a seamless part of the post-consumption journey. By connecting consumers with Scrapbuddy's doorstep collection service the brand is helping make responsible bottle disposal more convenient while contributing to a more circular future for plastic packaging.

IPL Schoeller & PureCycle Launch Off-the-Shelf Container Line, SnapPack Square EVO, Ahead of State Sustainability Mandates



PureCycle Technologies, Inc., a U.S.-based company revolutionizing plastic recycling, and IPL Schoeller, a global leader in sustainable packaging solutions, announced SnapPack Square EVO, a new sustainable option within IPL Schoeller's trusted family of tamper-evident packaging that will incorporate 20% PureFive® recycled polypropylene in every unit. The line gives brand owners an off-the-shelf packaging option that already meets emerging recycled content requirements, without the time or cost of a custom development program.

The launch builds on the companies' collaboration with Cleveland Kitchen, a supplier of private label refrigerated pickle products, to commercialize a sustainable food contact container containing PCR content. The success has led to an expansion of offerings from a single product into a standardized container platform available to all brand owners and retailers across multiple categories.

Every SnapPack Square EVO container in the line will contain 20% PureFive® resin, PureCycle's recycled polypropylene, which is produced through a patented dissolution process. The PureFive® resin has been recognized as qualifying recycled content under New Jersey's Recycled Content Law and is APR Certified for post-consumer recycled content.

The launch comes as retailers and brand owners face a growing patchwork of packaging regulation. New Jersey's Recycled Content Law currently requires rigid plastic packaging to contain a minimum of 10% post-consumer recycled content, a threshold that rises

to 20% and will include food packaging by 2027 and continues climbing to 50% by 2036. EPR laws in California, Oregon and other states will impose similar source reduction and recyclability requirements between 2027 and 2032, with the first deadlines arriving as soon as 2027. SnapPack Square EVO is intended to give brand owners and producers a ready path to compliance and a head start on meeting those requirements, without waiting on a custom qualification process.

"Brand owners are being asked to meet recycled content targets on a timeline that a custom packaging program often can't match," said Christian Bruey, PureCycle Director of Sustainability and External Affairs. "SnapPack Square EVO gives them a container that already contains PureFive® resin, already performs like the packaging they know, and is already built for the regulatory environment they're walking into. It's a way to move fast without reinventing a package from scratch."

"Our work with PureCycle on the Cleveland Kitchen container showed us that recycled content and performance don't have to be a trade-off," said Melissa Vettleson, IPL Schoeller Sustainability and Materials Engineer. "SnapPack EVO takes what we learned from that program and turns it into a standard offering, so any brand owner can bring PureFive® resin into their packaging without starting from zero. It's a faster, lower-risk way to build recycled content into a container line."

SnapPack EVO is expected to be available to brand owners starting Fall 2026, with additional sizes and formats planned as the line rolls out.

American Packaging Corporation Brings Performance and Visibility to Frozen Food Packaging



Standing out in the freezer aisle takes more than great products. It takes packaging built to capture attention, communicate quality, and deliver a seamless experience from freezer to table. Displayed behind freezer doors and in highly competitive aisles, frozen food packaging has only moments to capture consumer interest and influence purchasing decisions. APC's flexible packaging solutions combine shelf appeal, product protection, and functionality to help frozen food brands perform at every stage of the consumer experience.

Designed to meet the demands of frozen food applications, these packaging solutions feature award-winning printing technologies and materials built to resist cold temperatures and abrasion. Capabilities such as anti-fog windows, easy-open and reclose features, microwaveable steam-venting options, and APC's RE® sustainable packaging formats help brands create a product that is both functional and visually impactful.

Key performance attributes for frozen food packaging:

- Award-winning printing for bold, eye-catching shelf appeal
- Packaging designed to resist cold temperatures and abrasion
- Anti-fog windows that clearly showcase the product
- Easy-open and reclose features
- Microwaveable packaging with steam venting
- RE® sustainable packaging solutions, including Design for Recycle, Renewable Content, and Post Consumer Recycled (PCR) Content

American Packaging Corporation

A.T.E. HUBER ENVIROTECH

Stall No. - H 94

Hall No. - 3



A.T.E. HUBER Envirotech (AHET) is a leading wastewater treatment technology provider offering an array of innovative technologies for wastewater treatment, recycling, Zero Liquid Discharge (ZLD) and sludge management for industrial and municipal sectors. AHET is a joint venture between A.T.E., India, and HUBER SE, Germany, a global player in the field. AHET offers a wide range of technologies, including AVR-HDF® — a solution for the dairy, food, and beverage industries that can reduce the footprint up to 30% and lower COD up to 85–90%. Another solution is EnviroCOLA, a unique IoT product for monitoring wastewater treatment plants.

INOXPA INDIA PVT. LTD.

Stall No. - B 70

Hall No. - 2



JFM Verbruggen India Private Limited

Stall No. - C 106

Hall No. - 2



KARL SCHNELL

Stall No. - A 64

Hall No. - 2



DYNATECH MARKETING COMPANY

Stall No. - A 64

Hall No. - 2



METTLER-TOLEDO INDIA PVT. LTD.

Stall No. - L 51

Hall No. - 4



NORD DRIVESYSTEMS

Stall No. - H 73

Hall No. - 3



HRS PROCESS SYSTEMS LTD

Stall No. - F 82

Hall No. - 3



ADVANCED INDUSTRIAL MICRO SYSTEMS

Stall No. - N 111

Hall No. - 4



SUDINAM PHARMA EQUIPMENT

Stall No. - C 64

Hall No. - 2



JBT Marel

Stall No. - F16

Hall No. - 3



ITALIAN TRADE AGENCY

Stall - A 83

Hall - 2



Italian Trade Agency — ITA/ICE (ITA) is the Governmental agency that supports the business development of Italian companies abroad and promotes foreign investment in Italy. With a motivated and modern organization and a widespread network of overseas offices, ITA provides information, assistance, consulting, promotion and training to Italian businesses, with a special focus on small and medium-sized ones. Using the most modern multi-channel promotion and communication tools, it works to assert the excellence of Made in Italy in the world. The Italian Trade Agency in India was established in 1969 and is present with offices in New Delhi and Mumbai and a desk at the Consulate General of Italy in Bangalore.

Ali Group

Stall - A 81

Hall - 2



BMB

Stall - A 77

Hall - 2



Borelli Group

Stall - A 75

Hall - 2



MANN+HUMMEL Water & Membrane Solutions

Stall - A 79

Hall - 2



PIGO SRL

Stall - A 73

Hall - 2



TECALIT

Stall - A 71

Hall - 2



18th
Edition



Supported By



International Food & Beverage Trade Expo

December 09-11, 2026

Bombay Exhibition Center, Mumbai

Powering the future of F&B Trade

Key Highlights Of 2026

- » International hosted Buyers from around 30 countries
- » Presence of leading F&B importers, distributors, retailers and HoReCa professionals
- » Annapoorna Inter Food Awards
- » CEO Roundtable Discussion
- » Masterclasses by Celebrity Chefs
- » ALCOBEV Pavilion



Culinary Partner



Supporting Partners



✉ pr@vaexhibitions.com ✉ gurmeet.chawla@ficci.com
☎ +91 98675 00880 ☎ +91 95997 63563





28|29|30
APRIL 2027

Bharat Mandapam,
New Delhi



Shaping the Future of India's Dairy Sector

MEET KEY DECISION-MAKERS FROM ACROSS THE DAIRY INDUSTRY

- * DAIRY COOPERATIVES
- * PRIVATE DAIRY COMPANIES
- * MILK FEDERATIONS
- * DAIRY PLANT OWNERS
- * ENGINEERING CONSULTANTS
- * PROCUREMENT HEADS
- * PLANT & PRODUCTION MANAGERS
- * TECHNICAL DECISION-MAKERS
- * KEY DECISION-MAKERS

150+

Exhibitors

5,500+

Trade Visitors



Exclusive
CEO Roundtable



High-Quality
Technical Conference



Product Launches &
Live Technology
Demonstrations

BOOK YOUR
SPACE



BOOK BEFORE 1st OCT TO AVAIL THE
EARLY BIRD OFFER

For Sales Inquiries

Pallavi Naik M: +91 98922 48842
E: p.naik@koelnmesse-india.com

For Marketing & Alliances

Chandrika Thapa M: +91 88281 44168
E: c.thapa@koelnmesse-india.com



CONSISTENCY IN EVERY POUR

Every great sauce comes down to mouthfeel and cling.
Amylostar® provides unmatched thickening and stability,
ensuring a rich, high-gloss finish that holds its shape
under any cooking or storage condition.

AMYLOSTAR®



Design by THE S-SQUAD

BLUECRAFT AGRO PVT. LTD.

Manufacturers of Starch and Derivatives



Website



LinkedIn

10, Abhishree Corporate Park,
Ambli - Bopal Road, Ambli,
Ahmedabad - 380 058
+91-2717454547
marketing@bluecraftagro.com

FUNCTIONALITY

Better Thickness | Lasting Stability | Even Pour

FOOD SEGMENT PORTFOLIO

Food grade starch | Blucidex® Maltodextrin
Sorbitol | Liquid glucose | Amylostar® | Amylojel®



SEE MORE DETECT FASTER REPORT SMARTER

FLIR Advanced Condition Monitoring Solutions For Food & Beverage Manufacturing Industry

The food and beverage industry demands high standards of quality, safety, and efficiency. Flir helps manufacturers meet these demands by providing technology for quality assurance, process control, condition monitoring, and more. FLIR advanced solutions help you get ahead of problems before they impact operations & empowers your team to:

- ◆ Reduce unplanned shutdown
- ◆ Reduce energy loss from undetected leaks
- ◆ Improve maintenance response times
- ◆ Improve critical asset & facility maintenance
- ◆ Standardize reporting across teams
- ◆ Increase overall productivity
- ◆ Protect product quality & food safety



**Learn more
about FLIR**



Thermal & Acoustic Imaging | Test & Measurement Tools | Firefighting Cameras
Analysis Software | Secure Storage | Top-tier Service and Support

For more information, please call us at **+91-11-4560 3555**
or write to us at **flirindia@flir.com.hk**

Images for illustrative purposes only.